AEROSPACE REPORT NO.
ATR-75(7363)-3, VOL. III

Systems Cost/Performance Analysis (Study 2.3) Final Report

Volume III: Programmer's Manual and User's Guide

Prepared by

ADVANCED MISSION ANALYSIS DIRECTORATE
Advanced Orbital Systems Division

31 March 1975

Prepared for

OFFICE OF MANNED SPACE FLIGHT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D.C. 20546

Contract No. NASW-2727

Systems Engineering Operations
THE AEROSPACE CORPORATION

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(Supersedes and replaces ATR-74(7343)-1, Vol. III,
dated 27 September 1974)

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SYSTEMS COST/PERFORMANCE ANALYSIS
(STUDY 2.3) FINAL REPORT

Volume III: Programmer's Manual and User's Guide

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FOREWORD

This report documents The Aerospace Corporation effort on Study 2.3, Systems Cost/Performance Analysis, performed under NASA Contracts NASW-2575 and NASW-2727 during Fiscal Years 1974 and 1975. The effort was directed by Mr. B. H. Campbell. Mr. R. D. Kramer, Marshall Space Flight Center and Mr. R. R. Carley, NASA Headquarters were the NASA Study Directors for this study. Their efforts in providing technical direction throughout the duration of the study are greatly appreciated.

This volume is one of three volumes of the final report for Study 2.3. The three volumes are:

Volume I	Executive Summary
Volume II	Systems Cost/Performance Model
Appendix	Data Base
Volume III	Programmer's Manual and User's Guide

Volume I summarizes the overall report. It includes the relationship of this study to other NASA efforts, significant results, study limitations, and suggested additional effort.

Volume II provides a detailed description of the Systems Cost/Performance Model. It also includes the model checkout and the results for three payload test cases. The Data Base is provided in the Appendix to Volume II.

Volume III provides a detailed description of how the Systems Cost/Performance Computer Program is organized and operates. The program listing, detailed flow charts and user restrictions are included.

ACKNOWLEDGMENTS

The Aerospace Corporation effort on Study 2.3 was supported by various Members of the Technical Staff (MTS). The contributions of the following MTS to the Systems Cost/Performance Computer Program are gratefully acknowledged:

R. M. Harris
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J. C. Thacker

CONTENTS

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CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

FIGURES

TABLES

1. INTRODUCTION

The objective of the programming task within Study 2.3 was to implement the entire Systems Cost/Performance Model as a digital computer program. This document contains a discussion of the operating environment in which the program was written and checked; the program specifications such as discussions of logic and computational flow; the different subsystem models involved in the design of the spacecraft; and routines involved in the nondesign area such as costing and scheduling of the design. Preliminary results for the DSCS-II design are also included.

Section 2 of this volume covers the Operating Environment. This includes both hardware and software considerations for the UNIVAC 1108 and the CDC 7600.

Section 3 contains the Program Specifications. These include the computational flow, a discussion of the MACRO-MICRO concept, a detailed discussion of the COMMON structures used for communication in the model, and the Hardware Selection procedure.

Section 4 covers the subroutines that select hardware from the data base. These include Stabilization and Control (Subroutine SANDC), Auxiliary Propulsion (Subroutine AP), Data Processing and Instrumentation (Subroutine DPI), Communications (Subroutine COMM), and Electrical Power (Subroutine EP). A discussion of the communication with the main program is included along with the default parameters set in the DATA statements.

Section 5 covers the subroutines that do not select equipment, but do size or calculate information that is pertinent to the design. Subroutines included are: FILTER, which filters out incompatible designs; PRESET, which computes constants as a function of the inputs; INITIL, which initializes certain default numbers that are needed early in the model, but are not computed until later in the model; READDB, which reads the data base for any one subsystem at a time; SAVE, which saves

certain matrices to be used by later subroutines; VESIZE, the vehicle sizing routine that computes weights, lengths, and inertias for the design; STRUCT, that computes other mechanical design data needed to size the structure; RELY, which computes the reliability for the spacecraft; THRML, which computes the thermal requirements for the spacecraft; COSTS, which calculates the various costs involved in building and integrating the entire spacecraft system; SKED, which computes the schedule for the spacecraft from initial design phase to the launch phase; and PRNT, which outputs the final design attributes.

Section 6 contains a discussion of the data base format and tape requirements. Also discussed is the PRESORT routine which allows one to presort the data base into a different order based on cost, weight, or reliability.

Section 7 summarizes the restrictions and limitations established within the program.

Section 8 contains a discussion of the actual sample case used to check the program including all input default values and changes pertaining to the sample case. The results of the test case are discussed here also.

Sections 9 and 10 contain the source code listing and the detailed flow charts, respectively.

2. OPERATING ENVIRONMENT

Section 2 contains a description of the operating environment within which the program was coded and checked. Paragraph 2.1 summarizes the hardware involved and Paragraph 2.2 summarizes the software involved.

2.1 HARDWARE

2.1.1 Computer

UNIVAC 1108 and CDC 7600

2.1.2 Main Memory Utilization

a. UNIVAC 1108 (Octal Words)

135K (to compile)

135K (to link edit)

135K (to execute)

b. CDC 7600 (Octal Words)

120K (to compile)

20K (to link edit)

74K (to execute)

2.1.3 Magnetic Tapes

Optional for input or presort (see Paragraph 6.2).

2.1.4 Card Punch

Not required

2.1.5 Plotter

Not required

2.1.6 Disk

Optional for input or presort (see Paragraph 6.2).

2.2 SOFTWARE

2.2.1 Operating System

a. UNIVAC 1108

EXEC 8

b. CDC 7600

SCOPE 3.4.1 Vers. 373

2.2.2 Programming Language

FORTRAN

2.2.3 Type of Run

BATCH

2.2.4 Library Subroutines

SQRT

SIN

COS

TAN

ATAN

ARSIN (ASIN on the CDC 7600)

EXP

FLOAT

INT

ALOG

3. PROGRAM SPECIFICATIONS

Paragraph 3.1 contains a description of the overall program flow and a discussion of the MACRO-MICRO concept. Paragraph 3.2 contains a discussion of the common structures. Paragraph 3.3 contains a discussion of the hardware selection procedure. Detailed discussions of all subroutines can be found in Sections 4 and 5.

3.1 COMPUTATIONAL FLOW CHART

In general, it can be said that the program has an outer loop on configurations and an inner loop on iterations. The inner loop on interations includes the calling of all subsystem subroutines and for ITER = 0 the calling of the reliability subroutine. For ITER = 1 (second pass) reliability is bypassed. The structures, thermal, cost, and print subroutines are called once per outer loop on configurations. A general flow chart is shown in Figure 3-1.

3.1.1 MACRO-MICRO

A prerequisite to the understanding of the MACRO-MICRO concept is an understanding of "configuration." A set of rules for selecting equipments is associated with each subsystem. Which set of rules is to be used at any moment in time is determined by NCONF (configuration number) for that subsystem. For example, if NCONF (1) = 5, a star sensor will be selected by reference to the appropriate equations. However, if NCONF (1) = 1, a star sensor will never be selected. Thus, the configuration numbers determine a subset of the sets of equipments, and only this subset is considered for the configuration design.

A MACRO search is a method for testing all possible combinations of configuration numbers (one per subsystem) and determining within this subset of equipments and within the subset of selection procedures the first acceptable equipments for each. Some combinations of config-

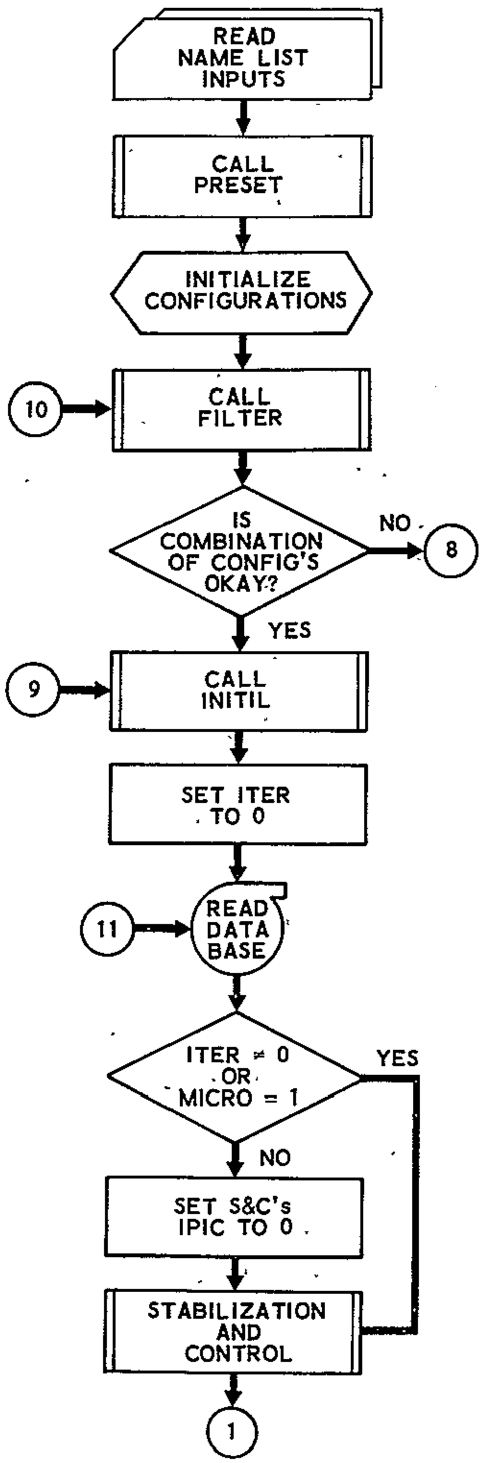

Figure 3-1. Main Program Logic

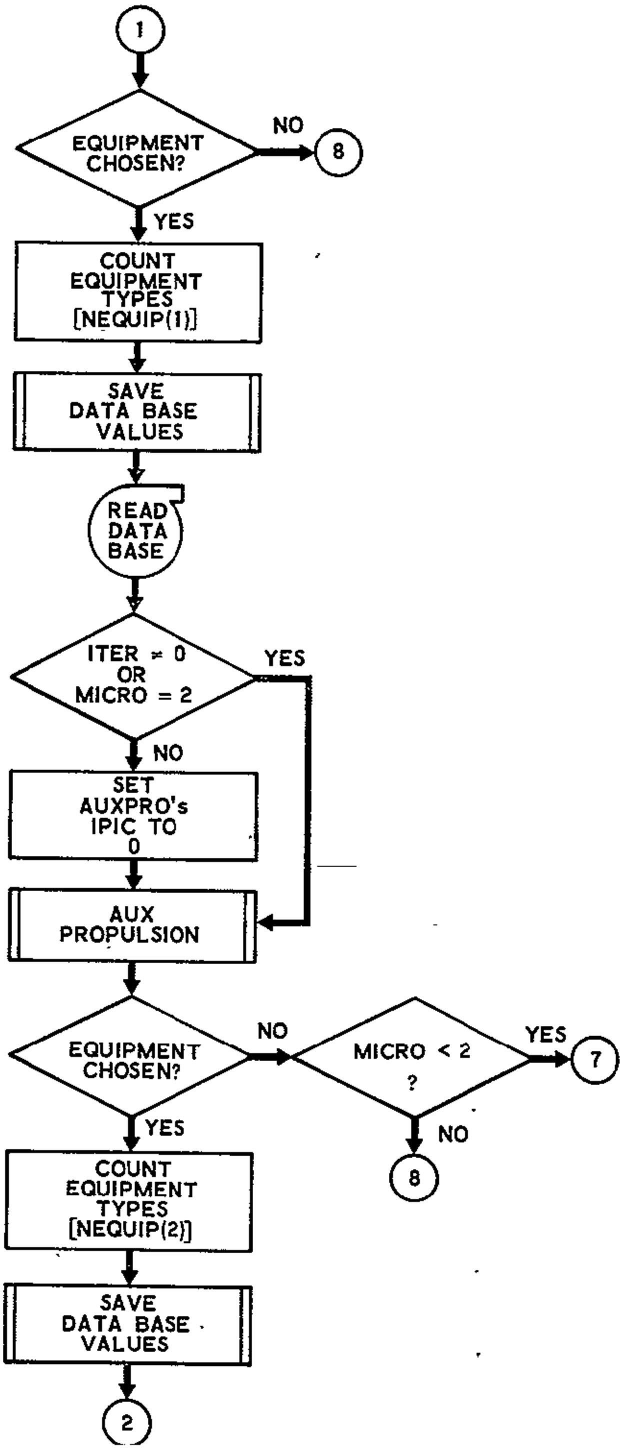

Figure 3-1. Main Program Logic (Continued)

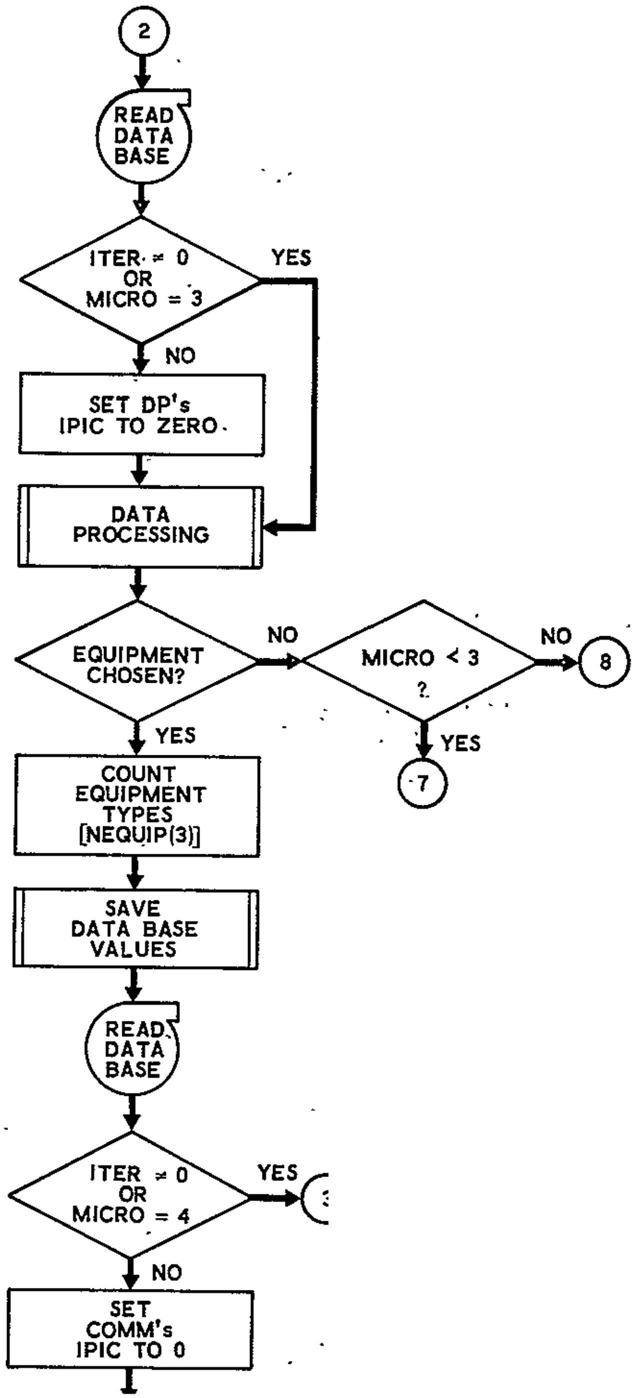

Figure 3-1. Main Program Logic (Continued)

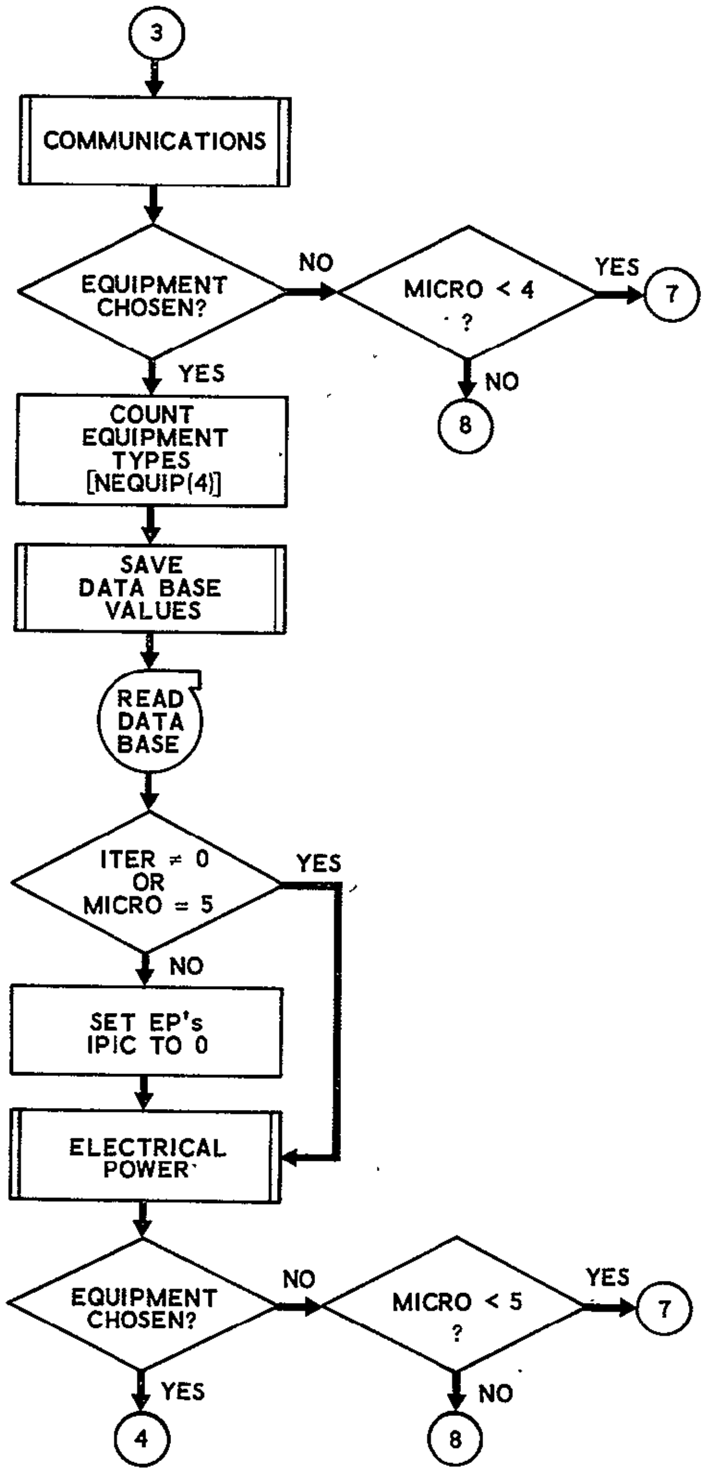

Figure 3-1. Main Program Logic (Continued)

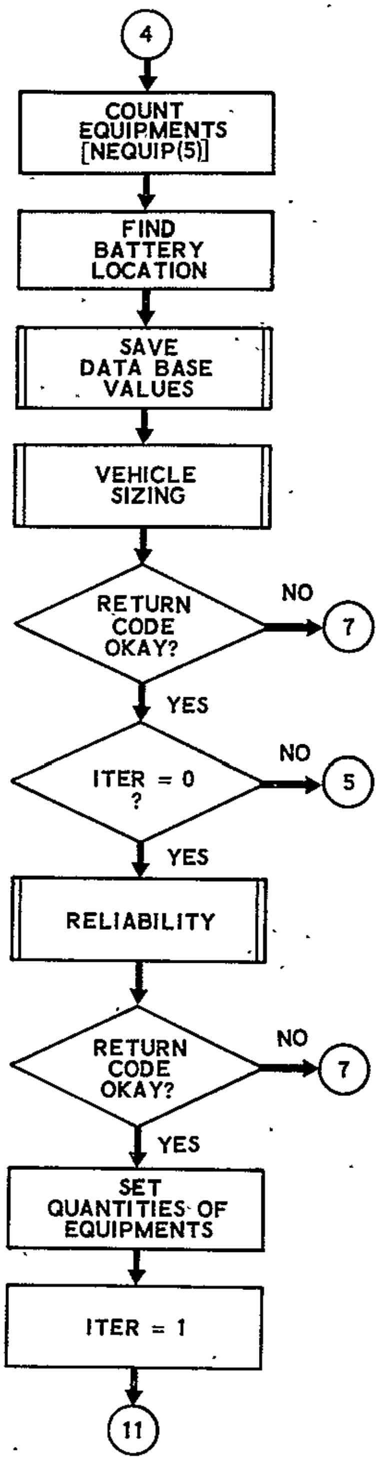

Figure 3-1. Main Program Logic (Continued)

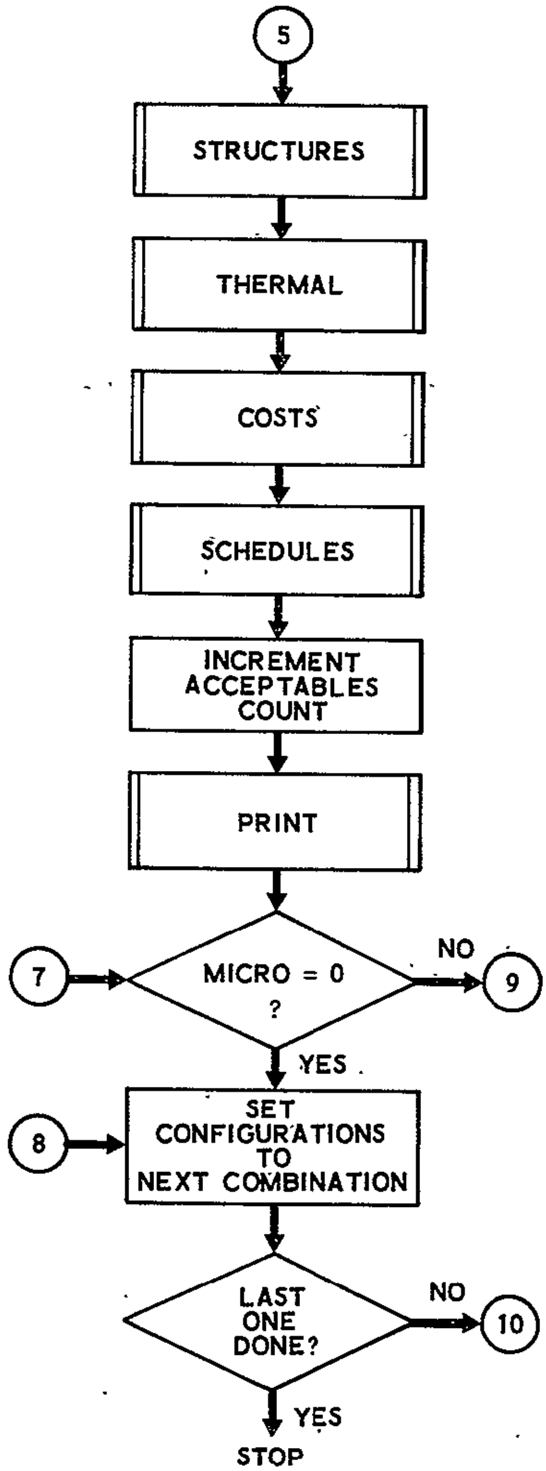

Figure 3-1. Main Program Logic (Continued)

urations are never acceptable, and some are ruled out by mission requirements; but a MACRO search will, in general, produce many acceptable designs.

In a MICRO mode all configuration numbers except the one being "MICROed" are fixed. Care must be taken that these numbers are compatible. For example, VESIZE should not be set to configuration 2 when SANDC is set at 2; that is, a box shape for the equipment bay is incompatible with dual spin. Within the subsystem being "MICROed", all configurations are checked and all possible combinations of equipments within the subset determined by configuration are checked. Within a configuration then, it is essentially the stopping point which determines the difference between a MACRO and a MICRO. A MACRO selects the first acceptable equipment in each category. The MICRO selects all combinations of acceptable equipments. The reader should note that in the current version of the program, equipments for which selection criteria are not available are not included in the MICRO "search."

3.2 COMMON REGIONS

The main COMMON regions consist of the USER series, DBCOM, CHOSE, PRTCOM and BTWN.

3.2.1 USER1, USER3, USER4, USER6, USER8, USER9, USERR, USERC, USERI, USERP

The various "user" COMMONS are for storage of user inputs. Variables included in each of these nine common areas are used by only one of nine major subsystems: Stabilization and Control, Data Processing and Instrumentation, Communications, Vehicle Sizing, Schedules, Structures, Reliability, Costs and Print. All user-specified values are preset to either default values or flags by the BLOCK DATA routine, but can be overwritten by values specified in the NAMELIST input from the user. The default flags inform subroutine PRESET to calculate (from other inputs) those variables which are not overwritten by user-supplied inputs. A complete list of all

variables in each of the user common areas as well as the applicable subsystem and namelist block names are given below. Refer to Paragraph 8.1 for a definition of each of these variables.

COMMON Block Name	Subsystem	Variable	NAMELIST Block Name
USER1	Stabilization and Control	ALPHA	OPTION
		AX	
		AY	
		AZ	
		DPHI	
		EA	
		EANT	
		EP1	
		K	
		MANV	
		OMEGR	
		PDOTAV	
		PDOTRX	
		PDOTRY	
		PDOTRZ	
		PDOTST	
		PDOTX	
		PDOTY	
		PDOTZ	
		PDOT0	
		PHIFOV	
		PHIRX	DESIRE
		PHIRY	
		PHIRZ	
		TACCEL	OPTION
		THETMX	
		THOLD	
		TL	
		TPMIN	
		TSMALL	
		XN	
		XNN	
		XNNN	
		XNU	
		YN	
		ZN	

COMMON Block Name	Subsystem	Variable	NAMELIST Block Name
USER3	Data Processing and Instrumentation	ARRAYN (11, 3)	DESIRE
		BTRMX	OPTION
		NMSEQ	DESIRE
		OPSMS	
		SCSFL	OPTION
		TPRFL	
USER4	Communications	BWIDTH (2)	OPTION
		FREQ (2)	
		FREQR	
		IOPTCM (3)	
		LINK	
		NADIR	
		NET	
USER6	Vehicle Sizing	CGEEX (9)	DESIRE
		EELOC (9)	
		EEQVL (9)	
		EM1YCG	
		EM1ZCG	
		EM2YCG	
		EM2ZCG	
		EQPF	OPTION
		ISBOFG	
		NUMEEQ	DESIRE
		XCGSA3	OPTION
USER8	Schedules	SKDME (7, 3)	DESIRE
USER9	Structures	CA	OPTION
		CE	OPTION
USERR	Reliability	ISPT	OPTION
		ISUB	
		KEOPT	
		RFIXED	
		SLBMX	
USERC	Costs	FEEPCT	OPTION
		IMETYP	DESIRE
		NFV	REQUIR
		NQV	
		PI	DESIRE

COMMON Block Name	Subsystem	Variable	NAMELIST Block Name
USERP	Print	IPRINT ITITLE	REQUIR *

In the above-mentioned COMMON regions the variables are either input from the user, defaulted by the BLOCK DATA routine or calculated by subroutine PRESET and used only by the subsystem mentioned. In the following COMMON region the variables are again either input from the user, defaulted by the BLOCK DATA routine or calculated by subroutine PRESET, but are used by more than one subsystem.

COMMON Block Name	Subsystem	Variable	NAMELIST Block Name
USERI	PRESET, COMM, SANDC	APOGEE	REQUIR
	COMM, DPI	COMRAT	OPTION
	PRESET, INITIL, VESIZE	DIAMAX	OPTION
	PRESET, INITIL, VESIZE	EEQWT (9)	DESIRE
	INITIL, EP	EPME	REQUIR
	PRESET, INITIL, VESIZE	EQM1WT	REQUIR
	PRESET, SANDC, VESIZE	EQM1XL	DESIRE
	PRESET, SANDC, VESIZE	EQM1YL	DESIRE
	PRESET, SANDC, VESIZE	EQM1ZL	DESIRE
	PRESET, INITIL, VESIZE	EQM2WT	REQUIR
	PRESET, SANDC, VESIZE	EQM2XL	DESIRE

* ITITLE is a special card input. It is the first card of any run prior to the NAMELISTs and describes the run (all 80 columns).

COMMON Block Name	Subsystem	Variable	NAMELIST Block Name
USERI	PRESET, SANDC, VESIZE	EQM2YL	DESIRE
	PRESET, SANDC, VESIZE	EQM2ZL	DESIRE
	SANDC, AUXPRO	FE (TTHST in AP)	OPTION
	PRESET, THERMAL, COMM	IAGNCY	DESIRE
	REL, COST	IDEBUG	OPTION
	THRML, COMM, SANDC	ISATOR (ISEQ, ISAT)	DESIRE
	PRESET, VESIZE	MB12SH	DESIRE
	ALL	MICRO	REQUIR
	EP, REL	OPTEMP	OPTION
	SANDC, PRESET THRML	ORBINC	OPTION
	PRESET, SANDC, EP	PERIGE	REQUIR
	PRESET, REL	RELME	DESIRE
	PRESET, REL	SPEC (6)	REQUIR
	PRESET, REL	SPEC1	REQUIR
	PRESET, INITIL, SANDC, REL	T	REQUIR
	SANDC, VESIZE	XCGSA1	OPTION
	COST, PRNT	XMER	DESIRE
	COST, PRNT	XMEU	DESIRE

3.2.2 DBCOM

DBCOM acts as storage for blocks of the data base. All data base values for one of the hardware selection subroutines (i.e., all 55 attributes associated with all equipments relevant to that subsystem) are read at one time. These values are stored in matrix DATAB (55, 100). In addition, the COMMON contains IDB(30), (see Paragraph 3.3) which is filled by the read routine. IDB(I) contains the last column number for the Ith equipment of the active subsystem.

3.2.3 CHOSE

The named COMMON block CHOSE contains values pertaining to equipment already chosen. ICHOSE(60) and NCHOSE(60) are concatenations of the separate ICHOSE(I) and NCHOSE(I) of each subsystem which selects hardware as discussed in Paragraph 3.3. COST(5, 60) is a matrix formed by selecting the following rows from the data base for each equipment selected:

Matrix	Row of DATAB	Description
COST (1,I)	46	Design engineering cost
COST (2,I)	47	Test and evaluation cost
COST (3,I)	48	Unit production cost
COST (4,I)	49	Reference quantity
COST (5,I)	50	Factor

SKD(7, 60) is a matrix formed by selecting the following rows from the data base for each equipment selected.

Matrix	Row of DATB	Description
SKD (1,I)	46	Design engineering cost
SKD (2,I)	47	Test and evaluation cost
SKD (3,I)	51	Development constant
SKD (4,I)	52	Development variable
SKD (5,I)	53	Qualification constant
SKD (6,I)	54	Qualification variable
SKD (7,I)	55	State-of-the-art factor

REL(6, 60) is a matrix formed by selecting the following rows from the data base for each equipment selected.

Matrix	Row of DATAB	Description
REL (1,I)	23	Weight
REL (2,I)	41	Failure model
REL (3,I)	42	λ or μ
REL (4,I)	43	σ
REL (5,I)	44	q
REL (6,I)	45	Maximum redundancy

THM(4, 60) is a matrix formed by selecting the following rows from the data base for each equipment selected:

Matrix	Row of DATAB	Description
THM (1,I)	17	Maximum power
THM (2,I)	18	Minimum power
THM (3,I)	27	Maximum temperature
THM (4,I)	28	Minimum temperature

DPIA(11, 60) is a matrix formed by selecting the following rows from the data base for each equipment selected:

Matrix	Row of DATAB	Description
DPIA (1,I)	30	Number power commands
DPIA (2,I)	31	Number other commands
DPIA (3,I)	32	Number time tags
DPIA (4,I)	33	Number high rate analog points
DPIA (5,I)	34	Number high rate digital points
DPIA (6,I)	35	High sample rate
DPIA (7,I)	36	Word length
DPIA (8,I)	37	Number low rate analog points

Matrix	Row of DATAB	Description
DPIA (9, I)	38	Number low rate digital points
DPIA (10, I)	39	Low sample rate
DPIA (11, I)	40	Word length

These matrices are needed by the subroutines that have similar names. For example, COST is used by COSTS, REL is used by RELY, SKD is used by SKED, THM is used by THRML, and DPIA is used by DPI.

3.2.4 PRTCOM

PRTCOM is used to pass values to the print subroutine which are not needed (except for output) outside of a given routine. A description of the variables in this COMMON block is given below:

Name	From	Units	Description
ACCRCY	SANDC	deg	S&C accuracy
AM	STRUCT	---	Number of frames
AN	STRUCT	---	Number of stringers
BF	STRUCT	in.	Frame height
BS	STRUCT	in.	Stringer height
CDPI (7, 2)	DPI, MIS	---	Engineering & mission equipment data for CDPI
CISTAR	EP	amp-hr	Battery capacity
CTOT	COST	$	Flight operations cost
DDTE	COST	$	DDT&E program total
DE	COST	$	Design engineering cost
DRIWT	AUXPRO	lb	Weight of AP less expendables
EQBSTR	VESIZE	lb	Equipment bay structure weight
FEEINV	COST	$	Investment contractor fee
FEEOPS	COST	$	Operations contractor fee

Name	From	Units	Description
FEER	COST	$	DDT&E contractor fee
GSE	COST	$	DDT&E GSE
IREL	RELY	---	0 means single system 1 means dual system
ITRUNC	RELY	---	Index for reliability
MMDOLD	RELY	mo	Mean mission duration
NAME (3,60)	SAVE	---	Name of equipment type
OPS	COST	$	Operations program total
PAYINV	COST	$	Total payload investment cost
PAYQUL	COST	$	DDT&E qual. units cost
PAYR	COST	$	DDT&E total payload cost
PE	COST	$	Unit engineering cost
PMP	COST	$	Investment program management cost
PMR	COST	$	DDT&E program management cost
POWER (6)	MAIN	watts	Power requirement of each subsystem
PU	COST	$	Unit production cost
PWR (60)	SAVE	watts	Power requirement of each component
QCP	COST	$	Investment quality control cost
QCR	COST	$	DDT&E quality control cost
ROLD(60)	RELY	---	Reliability of each module
SABMWT	VESIZE	lb	Solar array boom weight
SATADP	VESIZE	lb	Adapter weight
SATINV	COST	$	Spacecraft investment cost
SATR	COST	$	DDT&E spacecraft cost
SEIP	COST	$	Investment systems engineering & integration cost

Name	From	Units	Description
SEIR	COST	$	DDT&E systems engineering and integration cost
SKTAU(1)	SKED	mo	Design and component development time (critical subsystem)
SKTAU(2)	SKED	mo	Component qualification time (critical subsystem)
SKTAU(3)	SKED	mo	Subsystem development time (critical subsystem)
SKTAU(4)	SKED	mo	Subsystem qualification time (critical subsystem)
SKTAU(5)	SKED	mo	Subsystem development and flight readiness time (critical subsystem)
SKTAU (6)	SKED	mo	Total subsystem critical time
SSREL(6)	RELY	---	Subsystem reliabilities
SUBE(7)	COST	$	Subsystem design eng. cost
SUBT(7)	COST	$	Subsystem test & eval. cost
SUBUE(7)	COST	$	Subsystem unit eng. cost
SUBUP(7)	COST	$	Subsystem unit prod. cost
TA	STRUCT	in.	End cover thickness center
TAU(6, 6)	SKED	mo	Critical path for each subsys
TB	STRUCT	in.	End cover thickness aft
TC	STRUCT	in.	End cover thickness forward
TE	COST	$	Test and evaluation cost
TF	STRUCT	in.	Frame thickness
TOOLR	COST	$	DDT&E tooling and test equipment cost
TOOLU	COST	$	Investment tooling and test equipment cost
TOTOPS	DPI	ips	Computer operations rate
TRUNC	RELY	mo	Reliability truncation time
TS	STRUCT	in.	Stringer thickness
TTT	STRUCT	in.	Skin thickness

Name	From	Units	Description
VOLUME (6)	MAIN	ft^3	Subsystem volumes
VQL (60)	SAVE	ft^3	Component volumes
WEIGHT (6)	MAIN	lb	Subsystem weights
XLTOT	COST	$	Launch support opr. cost
XMEH	VESIZE	in.	Mission equipment height
XMEINV	COST	$	Mission equipment investment cost
XMEL	VESIZE	in.	Mission equipment length
XMEVL	VESIZE	ft^3	Mission equipment volume
XMEW	VESIZE	in.	Mission equipment width
XMEWT	VESIZE	lb	Mission equipment weight
XVEST	COST	$	Investment program total

3.2.5 BTWN

Communication of all design variables between subsystems is accomplished via COMMON block BTWN. A description of all variables contained in BTWN is given below:

Name	From	To	Units	Description
ACSSN	SANDC	REL	---	Number of sensors
ACSWP	AUXPRO	VS	lb	Propellant weight
ALT	PRESET	ALL	nmi	Average altitude
AREA	EP	VS	ft^2	Solar array area
BATCAP	EP	REL, PRNT	amp-hr	Battery capacity
BITRAT(2)	DPI	COMM	bps	Bit rate (mission equipment and housekeeping)
CLIFE	SANDC	AUXPRO	---	Cycle life of thrusters
CONVWT	SANDC & COMM	COSTS	lb	Converters weight
D	INITIL, VS	SANDC	ft	Vehicle diameter
DT	INITIL, VS	SANDC	ft	Dist. from c. g. to engine

Name	From	To	Units	Description
DX	INITIL, VS	SANDC	ft	Gas jet lever arm (roll, pitch, and yaw)
DY	INITIL, VS	SANDC	ft	
DZ	INITIL, VS	SANDC	ft	
EQBLG	PRESET, VS	SANDC	in.	Equipment bay length
EQBSID	PRESET, VS	SANDC	in.	Equipment bay side
FC	SANDC	REL	hr^{-1}	APS thruster cycle rate
FF	SANDC	AUXPRO	lb	Attitude & control thrust
HARNWT	VS	COSTS	lb	Harness weight (wiring)
HPT	THERMAL	PRNT	Btu/hr	Total heater power
HTPIPE	THERMAL	PRNT	Btu/hr	Heat pipe
HTPT	THERMAL	PRNT	Btu/hr	Total heat pipe
HTRPRB	THERMAL	PRNT	Btu/hr	Battery heater power
HTRPWR	THERMAL	PRNT	Btu/hr	Heater power
IBTLOC	EP	THERMAL	---	Battery location (column no.)
LMBDD	EP	RELY	---	Depth of discharge of battery capacity
NC	EP	RELY		Number of cells
OMEGS	PRESET	SANDC	rad/sec	Spin rate about yaw axis
PASSTR	VS	COSTS	lb	Equivalent structures weight
PJ	INITIL, VS	SANDC	$slug\text{-}ft^2$	Platform spin axis inertia
PL	ALL	EP	watts	Average power
PLMIN	ALL	EP	watts	Minimum power
POCNWT	SANDC & EP	PRNT, COST	lb	Power control weight
RADA	THERMAL	PRNT	ft^2	Radiator area
RADAB	THERMAL	PRNT	ft^2	Battery radiator area
RAT	THERMAL	PRNT	ft^2	Total radiator area
RJ	INITIL, VS	SANDC	$slug\text{-}ft^2$	Rotor spin axis inertia
SABOLG	VS	STRUCT	in.	Solar array boom length
SATLG	VS	THERMAL	ft	Vehicle length

Name	From	To	Units	Description
SATTWT	VS	PRNT	lb	Launch weight
SATWT	VS	PRNT	lb	Vehicle weight
SATXCG	INITIL, VS	SANDC	in.	X Axis center of gravity
SATYCG	INITIL, VS	SANDC	in.	Y Axis center of gravity
SATZCG	INITIL, VS	SANDC	in.	Z Axis center of gravity
SA1XL	INITIL, VS	SANDC	in.	X location of solar array
SA1YL	INITIL, VS	SANDC	in.	Y location of solar array
SA1ZL	INITIL, VS	SANDC	in.	Z location of solar array
SIDE	INITIL, VS	SANDC	in.	Side of box shape vehicle
SYSLB	VS	REL	lb	System weight
THCMWT	VS	COSTS	lb	Thermal control weight
THRUST(2)	SANDC	AUXPRO	lb	Attitude and translational thrusts
TI	SANDC	AUXPRO	lb-sec	Total impulse
TNKWT	AUXPRO	COSTS	lb	Propellant feed systems weight
TPRIM	REL	SANDC	mo	Mission length
VB	EP	VESIZE, PRNT	ft^3	Volume of battery
VCHP	THERMAL	PRNT	Btu/hr	Variable conductance heat pipe
VOL	ALL	VS	ft^3	Accumulated volume
WATE	EP	VS, RELY	lb	Solar array weight
WB	EP	VESIZE, PRNT	lb	Volume of battery
WBT	EP	VESIZE	lb	Weight of batteries
WT	ALL	VS	lb	Accumulated equipment wt.
XNZERO	EP	RELY	rad/sec	Orbital mean motion
XJ	INITIL, VS	SANDC	$slug\text{-}ft^2$	Vehicle inertia (roll, pitch, yaw)
YJ	INITIL, VS	SANDC	$slug\text{-}ft^2$	
ZJ	INITIL, VS	SANDC	$slug\text{-}ft^2$	

3.3 HARDWARE SELECTION PROCEDURE

This section describes the hardware selection procedure, the method of communication between the MAIN program and the hardware selection subroutines, and the general procedure used in systematically checking all hardware parameters until a component is found that meets the specifications. Discussions as to which hardware is selected can be found in the appropriate subsystem subroutine sections (see Section 4). There are five subroutines in which hardware is selected: SANDC (Stabilization and Control), AUXPRO (Auxiliary Propulsion), DPI (Data Processing and Instrumentation), COMM (Communications), and EP (Electrical Power). The procedures described in Table 3-1, Figures 3-2 and 3-3 are applicable to all of these subroutines.

Table 3-1. Hardware Selection Procedure in Kth Subsystem

Calling Sequence

SUBROUTINE SSK (IPIC, IERR, ITER, NCONF, ICHOSE, NCHOSE)

Definition of Variable Names

1.	IPIC(NSIZE)	=	hardware index indicating data base column NSIZE = maximum number of equipments sized for any configuration
2.	IERR	=	message flag 0 means no message 1 means first message only 10 means second message only . . . 111 means first, second and third messages are applicable
3.	ITER	=	iteration flag (0 means first time through)
4.	NCONF(6)	=	system configuration indices
5.	ICHOSE(NEQUIP)*	=	I.D. of hardware chosen NEQUIP = maximum equipments (in general, more than one manufacturer per equipment) in any configuration
6.	NCHOSE(NEQUIP)	=	number of identical pieces of hardware required

Additional Variables Used in Selection Procedure

7.	DATAB(NR, NC)	=	data base for subsystem NR = total equipment attributes NC = total number of individual pieces of hardware
8.	IDB(NTOTL)*	=	last hardware column index for all equipment NTOTL = total number of equipments in data base for this subsystem (all configurations)

* See Figure 3-2 for further explanation

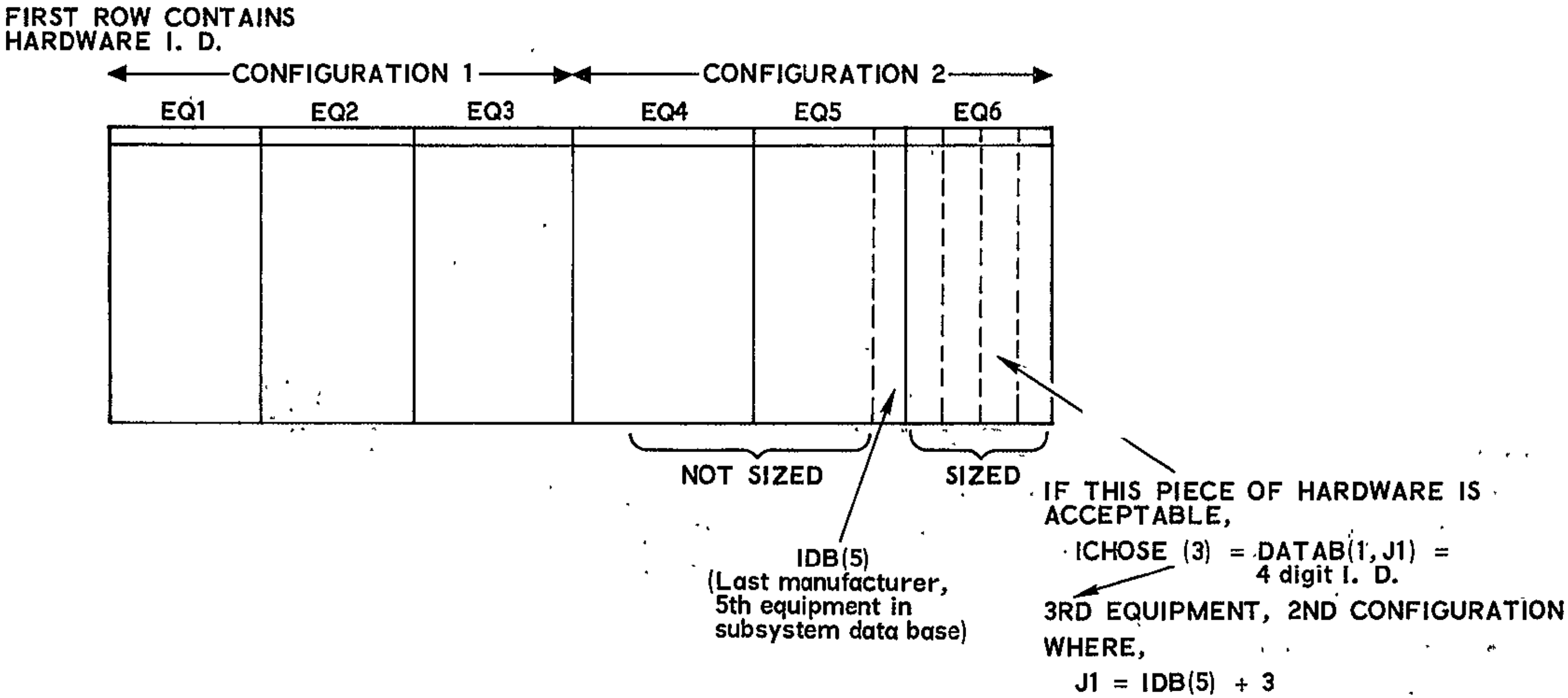

Figure 3-2. Explanation of Arrays: IDB and ICHOSE

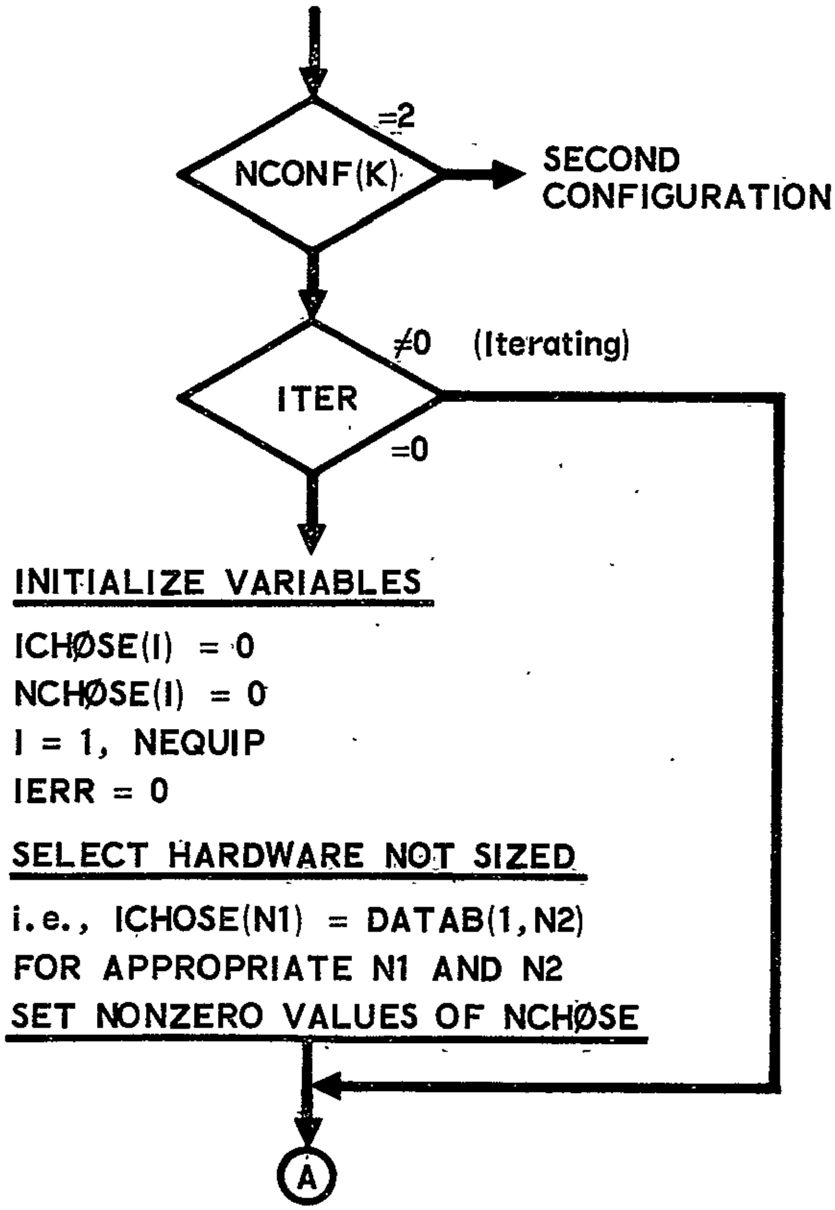

Figure 3-3. Hardware Selection Flow Chart

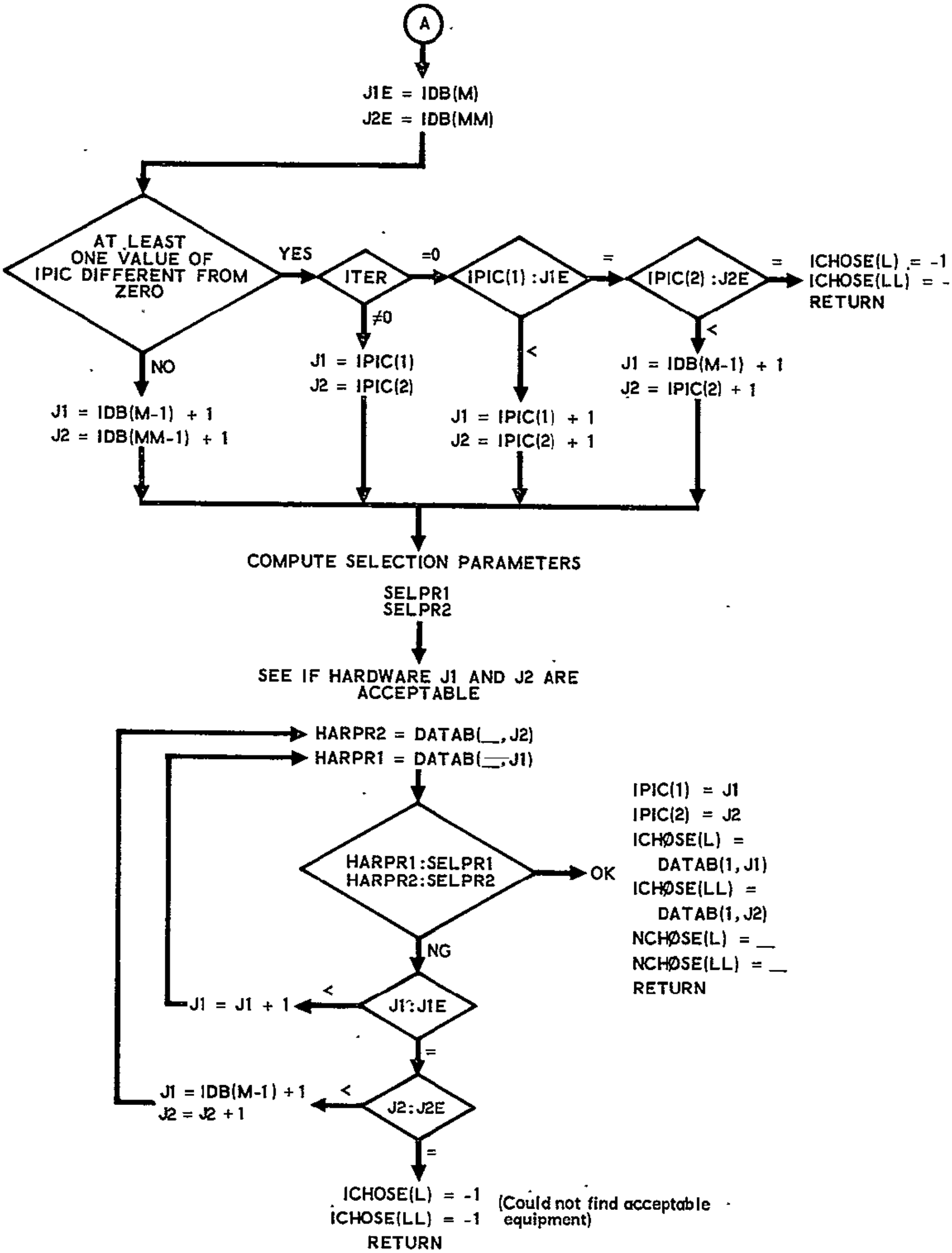

Figure 3-3. Hardware Selection Flow Chart (Continued)

4. SUBROUTINES WHICH SELECT HARDWARE

4.1 SUBROUTINE SANDC (IPIC, IERR, ITER, NCONF, ICHOSE, NCHOSE)

4.1.1 Purpose of Subroutine

The Stabilization and Control Subsystem stabilizes a spacecraft to a desired accuracy about a tracking line from a reference on the vehicle to an external reference. The external reference may be the local vertical of a planet, the sun, or a more distant star; an inertial reference; or the line of sight to a natural phenomenon like a gravity gradient or the lines of the earth's magnetic field. In many cases, a platform free to rotate with respect to the main structure of the vehicle must also be aligned with an external reference. The necessary accuracy of attitude stabilization depends, of course, on the mission of the vehicle.

In the beginning of SANDC, the subroutine computes the disturbance torques (XMD, YMD, and ZMD). These disturbance torques are the combination of gravity gradient torques, aerodynamic torques and solar torques. The solar or aerodynamic torques are a function of the altitude. The disturbance torques are then used in the selection criteria equations for all configurations.

The principal calculations, other than those necessary to select stabilization and control equipment, are contained in equations for thrust, cycle life, and total impulse. (These are necessary for the correct selection or sizing of equipment in auxiliary propulsion). Sensor selection is based on factors such as deadband and pointing errors (with respect to various axes). The equations for sensor selection tend to be quite complicated and involve user input, numbers from other subsystems, and values from the data base for many of the selected equipments. As an example, star sensors are selected on the basis of type (mappers or trackers), rate error, pointing error, sensitivity, and compatibility with the selected gyro and control moment

gyros (CMGs). CMGs are selected on the basis of momentum, gimbal rate, and torque. Reaction (or momentum) wheels are selected on the basis of the angular momentum required.

Those equipments which are not chosen on the basis of selection criteria in the model are simply "called up" from the data base.

The five configurations and their equipments are as follows:

a. Dual Spin [NCONF(1) = 1]

1.	Despin mechanical and electrical assembly	(called up)
2.	Valve driver assembly	
3.	Sun sensor	
4.	Nutation damper	
5.	Gimbal electronics	
6.	Control timing assembly	
7.	Gimbal drive assembly	
8.	Nonscanning earth sensor	(selected)
9.	Power converter	(called up)

b. Yaw Spin [NCONF(1) = 2]

1.	Sun sensor	(called up)
2.	ACS electronics	
3.	Rate gyro	
4.	Horizon sensor	(selected)
5.	Reaction wheel	
6.	Power converter	(called up)
7.	Valve driver	

c. Three-Axis Mass Expulsion [NCONF (1) = 3]

1.	Attitude reference electronics	(called up)
2.	Valve driver	
3.	Power converter	
4.	Rate integrating gyro	(selected)
5.	Scanning earth sensor	

d. Momentum Exchange [NCONF(1) = 4]

1.	Electronics processor	(called up)
2.	Valve driver	
3.	Horizon sensor or sun sensor	
4.	Control moment gyros	(selected)
5.	Rate integrating gyros	
6.	Star sensor	

e. Pitch Momentum Bias

1. Valve driver
2. Electronic error processor
3. Horizon sensor
4. Momentum wheel

(called up) (items 1–2)
(selected) (items 3–4)

4.1.2 Communication with Main Program

The variables in the calling sequence are discussed in Paragraph 3.3

User inputs are communicated by the COMMON areas USER1 and USERI. These are discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE and OPTION). Variables are passed to and received from other subroutines through the COMMON area BTWN, which is discussed in Paragraph 3.2. The fourth COMMON area in this subroutine is DBCOM, which contains all necessary data base values and an indexing scheme to reference the values. DBCOM is also discussed in Paragraph 3.2.

4.1.3 Variables Specified in DATA Statements

Four variables appear in DATA statements. Three of these (XMD2, YMD2, and ZMD2) are approximations for external torques (ft-lb). The other, DI, is a minimum gas jet on-time in seconds.

4.1.4 Other Subroutines Called

None

4.2 SUBROUTINE AUXPRO (IPIC, IERR, ITER, NCONF, ICHOSE, NCHOSE)

4.2.1 Purpose of Subroutine

The auxiliary propulsion subroutine selects hardware which is required to provide attitude control forces and stationkeeping or maneuvering forces. Three configurations are considered in the subroutine. These

configurations are characterized by the nature of the propellant under investigation: cold gas, monopropellant, bipropellant.

All thrusters, isolation valves, filters, regulators, and tanks are selected by comparing appropriate attributes listed in the data base with satellite performance requirements determined by the model. Thrusters are selected on the basis of thrust level, isolation valves on the basis of effective flow area, filters on the basis of flow impedance, regulators on the basis of effective flow area and pressure operating range, and tanks on the basis of volume and pressure.

The model does not include selection criteria for the fill and vent valves, fill and drain valves, or the relief valves. The first valves in the appropriate equipment slots in the data base are simply called up.

The sequence in which equipments are selected in each configuration are given below:

a. Cold Gas [NCONF(2) = 1]

1.	Attitude and control thrusters *	(selected)
2.	Translational thrusters *	
3.	Pneumatic isolation valves	
4.	Pneumatic filters	
5.	Pneumatic regulator	
6.	Pneumatic tank	
7.	Fill and vent valve	(called up)
8.	Relief valve	

b. Monopropellant [NCONF(2) = 2]

1.	Attitude and control thrusters *	(selected)
2.	Translational thrusters *	
3.	Fuel circuit isolation valves	
4.	Fuel circuit filters	
5.	Pneumatic regulator	
6.	Pneumatic isolation valve	

---

* Those thrusters which come closest to satisfying the thrust requirements are always chosen, whether the program is in a MICRO or MACRO mode of calculation.

7. Fuel tank ** } (selected)
8. Pneumatic tank
9. Fill and drain valve } (called up)
10. Fill and vent valve
11. Relief valve

c. Bipropellant [NCONF(2) = 3]

1. Attitude and control thrusters * } (selected)
2. Translational thrusters *
3. Fuel circuit isolation valves
4. Oxidizer circuit isolation valves
5. Fuel circuit filters
6. Oxidizer circuit filters
7. Pneumatic regulator
8. Pneumatic isolation valve
9. Fuel tank
10. Oxidizer tank
11. Pneumatic tank
12. Fill and vent valve
13. Fill and drain valves } (called up)
14. Relief valve

---

* Those thrusters which come closest to satisfying the thrust requirements are always chosen, whether the program is in a MICRO or MACRO mode of calculation.

** A multiple fuel tank option is available; that is, among all fuel tanks in the data base which satisfy the pressure requirement, there may not be a single tank which satisfies the volume requirement. In this case, a sufficient number of the largest tank in this subset is chosen to satisfy the volume requirement.

Plumbing and connector weight in each configuration is estimated from the combined tank weight.

4.2.2 Communication with Main Program

The variables listed in the calling sequence are common to all subroutines which select hardware and are discussed in Paragraph 3.3.

In addition to the calling sequence, subroutine AUXPRO communicates with the main program via three COMMON blocks: USERI, BTWN, and DBCOM. Variables coming through USERI are user inputs discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE and OPTION). The variables in BTWN and DBCOM are discussed in Paragraph 3.2.

4.2.3 Variables Specified in DATA Statements

DATA XMR/1.5/

XMR = mixing ratio for bipropellant configuration

4.2.4 Other Subrountines Called

None

4.3 SUBROUTINE DPI (IPIC, IERR, ITER, NCONF, ICHOSE, NCHOSE, NOWAT)

4.3.1 Purpose of Subroutine

The data processing and instrumentation subroutine selects hardware which is required for mission equipment data processing, command decoding, and monitoring purposes. Two configurations are considered in the subroutine: general purpose processing and special purpose processing. In the general purpose mode, a computer on board the satellite performs all data processing tasks unless there is a requirement for separate processing of telemetry data. In this case, a separate digital telemetry unit (DTU) is used to process the housekeeping data. In the special purpose mode, all processing is performed by DTUs. If the communications configuration involves uplink plus downlink, unified link-common antenna, or unified

link-separate antennas, a single DTU performs all mission equipment and housekeeping data processing. If the communications configuration involves unified link-common antenna plus downlink, or unified link-separate antennas plus downlink, one DTU is used for mission equipment data processing and one DTU is used for housekeeping data processing.

The general purpose computer is selected on the basis of total required instructions (or operations) per second. The DTUs are not sized. The first DTUs in the appropriate equipment slot in the data base are simply called-up.

The following quantities are computed in the sequence indicated:

a. Requirement for a digital multiplexer
b. Number of mainframe words
c. Word length
d. Bit rate
e. Number of words per subframe
f. Number of subframes

The above quantities are computed regardless of the configuration in subroutine DPI. Depending on the configuration, the following operations are performed in the sequence indicated:

a. <u>General Purpose Processing [NCONF(3) = 1]</u>
   1. If telemetry data is processed separately, select one DTU. Otherwise, compute telemetry operations per second.
   2. Compute attitude control, command, and total operations per second.
   3. Select general purpose computer.
b. <u>Special Purpose Processing [NCONF(3) = 2]</u>
   1. Depending on the communications configuration (as discussed previously), a DTU may or may not be selected for mission equipment data processing.
   2. Select DTU for housekeeping data processing.

4.3.2 Communication with Main Program

The variables listed in the calling sequence with the exception of NOWAT, are common to all subroutines which select hardware and are discussed in Paragraph 3.3. NOWAT is one greater than the number of entries in the ARRAY table (i.e., DPIA matrix in Paragraph 3.2).

In addition to the calling sequence, subroutine DPI communicates with the main program via six COMMON blocks: CHOSE, BTWN, DBCOM, USERI, USER3, and PRTCOM. Variables coming through USER3 are user inputs described in Paragraph 8.1 (see NAMELIST REQUIR, DESIRE and OPTION).

4.3.3 Variables Specified in DATA Statements

DATA ACSRT, ACSOP, COMOP, OPREQ/10., 50., 6., 4./

where:

ACSRT	=	ACS rate (sec^{-1})
ACSOP	=	ACS operations
COMOP	=	Command operations
OPREQ	=	TLM operations required

4.3.4 Other Subroutines Called

4.3.4.1 Subroutine MIS (IPIC, IERR, ITER, NCONF, ICHOSE, NCHOSE)

The purpose of this subroutine is to select a DTU for mission equipment data processing. It is called from subroutine DPI in the special purpose processing configuration for the specific communications configurations discussed in Paragraph 4.3.1. The same six quantities (i.e., requirement for digital multiplexer, number of mainframe words, word length, bit rate, number of words per subframe, and number of subframes) which are computed in subroutine DPI for all equipment on board the satellite are computed for the mission equipment in subroutine MIS.

The variables listed in the calling sequence are discussed in Paragraph 3.3.

4.3.4.2 Subroutine ORDER (N, A, B, C, XM2, MEDIAN)

The purpose of this subroutine is to order array A from the highest to the lowest entry and determine the median entry in this array. The high rate telemetry points are ordered with respect to both sample rate and word length while the low rate telemetry points are ordered only with respect to sample rate. This information is used to determine mainframe sample rate and maximum word length.

This subroutine is called by both subroutines DPI and MIS. The variables in the calling sequence are defined as follows:

N	=	Number of entries in telemetry points table
A	=	One-dimensional array consisting of sample rates or word lengths
B	=	One-dimensional array consisting of number of analog and digital points
C	=	One-dimensional array consisting of sample rates or word lengths
XM2	=	Twice the median value of array A after it has been ordered
MEDIAN	=	Median entry in array A

4.4 SUBROUTINE COMM (IPIC, IERR, ITER, NCONF, ICHOSE, NCHOSE)

4.4.1 Purpose of Subroutine

The communication subroutine selects hardware for the satellite command and telemetry system. Five configurations are provided for in the subroutine. These are determined by the complexity of the data processor being used and the amount of data to be transmitted. The pieces of equipment which may be selected are: baseband assembly unit, transmitter antenna(s), transmitter(s), receiver antenna, receiver, diplexer, and signal conditioner. The pieces chosen and the number chosen are configuration dependent. Each piece of equipment to be chosen is selected by comparing the attributes as computed from the user input, configuration number, and default parameter values, with the attributes for that piece of equipment in the data base.

There are pieces of equipment which have constraints placed on them for the selection process. For example, a given baseband assembly unit may be constrained for use with a given transmitter and no other. These constraints are built into the data base.

The sequences in which equipment are selected in each configuration are given below:

a. <u>Uplink Plus Downlink [NCONF(4) = 1]</u>

1. Transmitter antenna
2. Transmitter
3. Receiver antenna
4. Receiver
5. Signal conditioner

(selected)

b. <u>Unified Link, Common Antenna [NCONF(4) = 2]</u>

1. Baseband assembly unit
2. Antenna
3. Transmitter
4. Receiver
5. Signal conditioner
6. Diplexer

(selected)

c. <u>Unified Link, Separate Antennas [NCONF(4) = 3]</u>

1. Baseband assembly unit
2. Transmitter antenna
3. Transmitter
4. Receiver antenna
5. Receiver
6. Signal conditioner

(selected)

d. <u>Unified Link, Common Antenna plus Downlink [NCONF(4) = 4]</u>

1. Baseband assembly unit
2. Transmitter antenna (unified)
3. Transmitter antenna (nonunified)
4. Transmitter (unified)
5. Transmitter (nonunified)
6. Receiver
7. Signal conditioner
8. Diplexer

(selected)

e. Unified Link, Separate Antennas plus Downlink [NCONF(4) = 5]

1. Baseband assembly unit
2. Transmitter antenna (unified)
3. Transmitter antenna (nonunified)
4. Transmitter (unified)
5. Transmitter (nonunified)
6. Receiver antenna
7. Receiver
8. Signal conditioner

(selected)

4.4.2 Communication with Main Program

The variables listed in the calling sequence are common to all subroutines which select hardware and are discussed in Paragraph 3.3.

In addition to the calling sequence, Subroutine COMM communicates with the main program via four COMMON blocks: USER4, USERI, BTWN, and DBCOM. Variables coming through USER4 and USERI are user inputs discussed in Paragraph 8.1 (see NAMELIST REQUIR, DESIRE and OPTION). The variables in BTWN and DBCOM are discussed in Paragraph 3.2.

4.4.3 Variables Specified in DATA Statements

```
DATA SIGNOI/10.,10./, LMARG/6.,6./, SLANT/-1.E+10/,
     GTOT/-1.E+10/, GR/-1.E+10/, T/-1.E+10/, NF/-1.E+10/;
     TCLOSS/0.,0./, POLOSS/0./, GAMMA/.1/, BETA/1.8/,
     GT/-1.E+10, -1.E+10/, MODX/0., 0./, ANTLOS/0./,
     COVER/0./
```

where:

SIGNOI(2)	=	Signal-to-noise ratios for transmitter(s) (dB)
LMARG(2)	=	Link margin(s) (dB)
SLANT	=	Slant range (nmi)
GTOT	=	Gain-to-temperature ratio
GR	=	Receiving antenna (downlink) gain (dB)
T	=	System noise temperature (^{o}K)
NF	=	Noise figure (dB)

TCLOSS(2)	=	Transmitter(s) circuit loss
POLOSS	=	Polarization loss
ANTLOS	=	Satellite antenna off-axis loss
GAMMA	=	PRN modulation index
BETA	=	Subcarrier modulation index
GT(2)	=	Antenna(s) gain (dB)
MODX(2)	=	Transmitter(s) modulation type MODX = 0 no equipment dependence MODX = 1 phase modulation MODX = 2 frequency modulation MODX = 3 amplitude modulation
COVER	=	Transmitter antenna coverage (in percent)

4.4.4 Other Subroutines Called

4.4.4.1 Subroutine BESS (X, BESJ, NMAX)

This subroutine uses a recursive procedure for evaluating tables of the Bessel function, $J_n(x)$.

The variables in the calling sequence are defined as follows:

X	=	floating point single precision argument
BESJ	=	one-dimensional array of values of $J_n(x)$
NMAX	=	one less than the number of values in BESJ array: i.e., BESJ $(n + 1) = J_n(x)$, $n = 0, \ldots, /\text{NMAX}/$

4.4.4.2 Function RESET (K)

This subroutine, as the name implies, resets or initializes equipment indices in the data base.

4.5 SUBROUTINE EP (IPIC, IERR, ITER, NCONF, ICHOSE, NCHOSE)

4.5.1 Purpose of Subroutine

The electrical power subroutine selects hardware which is required to regulate the electrical power for the spacecraft and batteries to store the electrical power. Six configurations are considered in the subroutine. These configurations are characterized by the nature of the regulation and the configuration of the solar arrays.

All regulators, batteries and battery chargers are selected by comparing appropriate attributes listed in the data base with satellite performance determined by the model. Regulators are selected on the basis of their ability to regulate the power load, batteries on the basis of the capacity needed during the eclipse portion of orbit, and battery chargers on the basis of being able to use the excess power to store energy back into the battery.

The model does not include selection criteria for power control units, central control units, solar power distributor, and power distributors. The first equipments available in the data base are simply called up. The solar array area and weight are sized primarily on the average power load required for the spacecraft.

The sequences in which equipments are selected in each configuration are given below:

a. Shunt Regulation - Paddle or Body Mounted Arrays [NCONF(5) = 1 or 2]

1. Shunt regulator
2. Battery
3. Battery charger

} (selected)

4. Power control unit (called up)

b. Shunt and Discharge Regulation - Paddle or Body Mounted Arrays [NCONF(5) = 3 or 4]

1. Discharge regulator
2. Shunt regulator
3. Battery
4. Battery charger

} (selected)

5. Central control unit (called up)

c. Series Load Regulation - Paddle or Body Mounted Arrays [NCONF(5) = 5 or 6]

1. Series load regulator
2. Battery (selected)
3. Battery charger
4. Power distributors (called up)
5. Solar power distributors

4.5.2 Communication with Main Program

The variables listed in the calling sequence are common to all subroutines which select hardware and are discussed in Paragraph 3.3.

In addition to the calling sequence, subroutine EP communicates with the main program via four named COMMON blocks: PRTCOM, USERI BTWN, and DBCOM. Variables coming through USERI are user inputs discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE and OPTION). The variables in BTWN, DBCOM and PRTCOM are discussed in Paragraph 3.2.

4.5.3 Variables Specified in DATA Statements

```
DATA DELF/.03/, DELI/.02/, DELM/.01/, ETAI/.105/,
     ETAR/1.0/, K1/1.02/, K2/1.4/, LMBDP/.9/, SOL/1353./,
     VC/1.1/, PIE/3.1416/, CHMINT/2.0/
```

where:

DELF	=	Coverglass and coverglass adhesive transmissivity loss factor (dimensionless)
DELI	=	Array fabrication loss factor (dimensionless)
DELM	=	Miscellaneous loss factor (dimensionless)
ETAI	=	Solar cell efficiency at 28°C, AMO illumination (dimensionless)
ETAR	=	Power distribution loss factor (array to loads)
K1	=	Battery packing factor (dimensionless)
K2	=	Battery structure weight factor (dimensionless)
LMBDP	=	Solar array factor (dimensionless) (active surface area/actual surface area)
SOL	=	Average solar intensity (watts/meter^2)

VC	=	Minimum allowable cell voltage (V dc)
CHMINT	=	Minimum allowable charge time (hr)

4.5.4 Other Subroutines Called

None

5. SUBROUTINES WHICH DO NOT SELECT HARDWARE

5.1 SUBROUTINE PRESET (IERR)

5.1.1 Purpose of Subroutine

The purpose of the subroutine PRESET is to calculate values for those input variables for which flags have been specified, provided these flags have not been overwritten by user supplied inputs.

5.1.2 Communication with Main Program

IERR is a flag that informs the main program that subsystem reliabilities cannot be preset with the given information. Subroutine PRESET communicates with the main program via four named COMMON blocks: USER1, USERR, USERI and BTWN. Variables coming through USER1, USERR, and USERI are discussed in Paragraph 8.1.

5.1.3 Variables Specified in DATA Statements

None.

5.1.4 Other Subroutines Called

None.

5.2 SUBROUTINE FILTER (NCONF, ICODE)

5.2.1 Purpose of Subroutine

Some combinations of configurations are known to be unacceptable. These are filtered out without the necessity of calling any subsystems. As an example, configuration 1 in SANDC and configuration 1 in EP are incompatible because 1 in SANDC is a spinning vehicle and 1 in EP requires solar array paddles which cannot be used on a spinning vehicle. A complete description of these restrictions is presented in Section 7.

5.2.2 Communication with Main Program

NCONF is an array containing the number of each subsystem's configuration. ICODE is a return code of 0 for compatible configurations or -1 for unacceptable combinations of configurations.

FILTER also uses values from COMMONs USER1, USER3, USER4, and USERI, all of which are discussed in Paragraph 8.1.

5.2.3 Variables Specified in DATA Statements

None.

5.2.4 Other Subroutines Called

None.

5.3 SUBROUTINE INITIL (NCONF, IERRI)

5.3.1 Purpose of Subroutine

Some values are needed before they are calculated. For example, subroutine SANDC needs moments and lengths which are calculated "downstream" in vehicle sizing. Approximations for such values are calculated here.

5.3.2 Communication with Main Program

NCONF is discussed in Paragraph 3.1.1. IERRI is a flag which is set when the estimated satellite diameter exceeds the maximum allowable size. Subroutine INITIL communicates with the main program via four named COMMON blocks: USER1, USERI, BTWN and PRTCOM.

5.3.3 Variables Specified in DATA Statements

None.

5.3.4 Other Subroutines Called

None.

5.4 SUBROUTINE READDB (IENDDB)

5.4.1 Purpose of Subroutine

This subroutine reads all data base values for one subsystem at a time and determines the IDB array. Of major importance are the equipment numbers which exist as the first two digits of the four digit equipment identification numbers. These are counted by groups (all 1's, all 2's, all 3's, ...) and these counts exist as IDB(1), IDB(2), and so on. The routine returns when equipment for the next subsystem is encountered, i.e., when the equipment numbers begin to decrease.

5.4.2 Communication with Main Program

IENDDB is the last column in the data base for the active subsystem. This is needed for the SAVE routine. DBCOM is the common area in which the data base values for each subsystem are stored (see Paragraph 3.2).

5.4.3 Variables Specified in DATA Statements

DATA STORE/55*0./

STORE = variable used for temporary storage

5.4.4 Other Subroutines Called

None

5.5 SUBROUTINE SAVE (IIN, NIN, NOWAT, ITEST, IENDDB)

5.5.1 Purpose of Subroutine

The purpose of this subroutine is to build matrices needed by other subsystems. Specifically this routine concatenates separate ICHOSE and NCHOSE arrays (with zeros taken out) which contain the hardware I.D.'s of the equipment selected for the five satellite subsystems and the number of each equipment type. It also saves the data required to fill the COST, REL, THM, DPIA, and SKD arrays for their subroutines and the component volume, power and name for the PRNT routine.

5.5.2 Communication with Main Program

IIN and NIN are ICHOSE and NCHOSE of the active subsystem (described in Paragraph 3.3). (NOWAT is described in Paragraph 4.3.) ITEST is the largest possible number of types of equipment chosen by a subsystem. The three COMMON areas (DBCOM, CHOSE, PRTCOM) which are also used for communication with the main program are discussed in Paragraph 3.2.

5.5.3 Variables Specified in DATA Statements

None.

5.5.4 Other Subroutines Called

None.

5.6 SUBROUTINE VESIZE (IERR, NCONF, ICHOSE)

5.6.1 Purpose of Subroutine

The vehicle sizing subroutine determines the satellite structural weight, the total weight, the satellite volume, dimensions, center of gravity locations and the satellite inertial characteristics. Three configurations are considered in the subroutine. These configurations are characterized by the shape of the equipment bay: cylinder, box, sphere. This corresponds to NCONF(6) = 1, 2, 3, respectively.

The following quantities are computed in the sequence indicated:

a. Equipment bay equipment weight and volume
b. Equipment bay length
c. Satellite length
d. Solar array dimensions
e. Equipment bay structural weight
f. Mission equipment bay structural weight
g. Mission equipment support weight
h. Total volume of mission equipment bay

i. Solar array boom and mechanism weight (paddles)

j. Total mission equipment and external equipment weight and volume

k. Harness weight

l. Structural thermal protection system weight

m. Satellite dry weight

n. Satellite gross weight

o. Satellite launch weight

p. Mission equipment and mission equipment bay structure CGs

q. Equipment bay structure CGs

r. External equipment CGs

s. Solar array CGs

t. Satellite CGs

u. Equipment bay structure and equipment bay equipment incremental inertia

v. External equipment incremental inertia

w. Solar array incremental inertia

x. Mission equipment bay incremental inertia

y. Total satellite inertia

z. Distance from satellite CG to main engine

a. Gas jet lever arms on roll, pitch, and yaw axes

5.6.2 Communication with Main Program

All three variables listed in the calling sequence are discussed in Paragraph 3.3. (In this subroutine ICHOSE is a scalar which is set to -1 when the current design is unacceptable.)

In addition to the calling sequence, subroutine VESIZE communicates with the main program via four COMMON blocks: USERI, USER6, BTWN, and PRTCOM. Variables coming through USERI and USER6 are user inputs discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE, and OPTION). The variables in BTWN and PRTCOM are discussed in Paragraph 3.2.

5.6.3 Variables Specified in DATA Statements

None.

5.6.4 Other Subroutines Called

None.

5.7 SUBROUTINE STRUCT (NCONF)

5.7.1 Purpose of Subroutine

The structures subroutine specifies the satellite loads environment and sizes the solar array extension supports, the equipment bay structure, the end covers and the midsection bulkhead if appropriate. One configuration is considered in the subroutine. This configuration is characterized by the type of equipment bay structure: semi-monocoque.

The following quantities are computed in the sequence indicated:

a. Solar array paddle applied load
b. Nominal radius and wall thickness of solar array extension supports
c. Loads applied to equipment bay structure
d. Equivalent axial load on semi-monocoque structure
e. Equivalent thickness of stiffened cylinder
f. Skin thickness of skin-stringer assembly
g. Stringer thickness, height, spacing, and efficiency
h. Number of stringers
i. Cylinder frame, radius of gyration, area, height, thickness and spacing
j. Number of frames
k. Forward and aft end cover thickness
l. Applied uniform load on midsection bulkhead
m. Midsection bulkhead thickness

If the equipment bay shape is a box instead of a cylinder, quantities comparable to those listed above in steps d - k are computed for the box shape.

5.7.2 Communication with Main Program

The variable in the calling sequence is discussed in Paragraph 3.3. In addition to the calling sequence, subroutine STRUCT communicates with the main program via four COMMON blocks: USER9, USERI, BTWN, and PRTCOM. Variables coming through USER9 and USERI are user inputs discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE, and OPTION). The variables in BTWN and PRTCOM are discussed in Paragraph 3.2.

5.7.3 Variables Specified in DATA Statements

DATA E, XNU, RHO, SIGY, PI/1.E7, .33, .1, 3.E4, 3.1416/

where:

E	=	Young's modulus (psi)
XNU	=	Poisson's ratio
RHO	=	Weight density (lb/in^3)
SIGY	=	Yield stress (psi)

5.7.4 Other Subroutines Called

None.

5.8 SUBROUTINE RELY (IRTN, IDS, NEQUIP)

5.8.1 Purpose of Subroutine

The reliability subroutine incrementally increases the level of redundancy in the spacecraft system until the system reliability, R(TRUNC), and the mean mission duration, MMD, specifications are met. The procedure is constrained by a maximum total satellite weight or cost and available equipment reserves. The subroutine operates to meet the system reliability specification prior to meeting the mean mission duration requirement.

Two configurations are considered in the subroutine. These configurations are single system redundancy and dual system redundancy. This corresponds to NCONF(7) = 0, 1 respectively.

The principle of operation is to add a redundancy to a single module, then calculate the new system reliability and the payoff, as defined by

$$RHO = \frac{\Delta R(TRUNC)}{\Delta weight}$$

This is repeated for each module where equipment reserves are available. The module offering the greatest payoff is selected, and the following three tests are applied:

a. Is RHO large enough? (The threshold is preselected.)

b. Is spacecraft weight or cost below the maximum allowed?

c. Is the R(TRUNC) still short of the requirement?

If these tests are passed, the subroutine begins the selection process again. This loop is retraced until one or more of the tests is failed. Failure of tests a or b results in termination of the design procedure. If a configuration is found which meets the system reliability requirement, then the above is repeated replacing R(TRUNC) with MMD. A final design is recognized as optimum subject to the imposed R(TRUNC), MMD, weight, and cost constraints.

The subroutine contains the additional feature in that subsystem reliabilities may be specified. The task of meeting subsystem requirements is performed prior to any total system considerations. The same logic as presented above is used for determining the appropriate subsystem redundancies.

5.8.2 Communication with Main Program

The variables listed in the calling sequence are: a return indicator, a double string design indicator, and a vector of the number of equipment types per subsystem, respectively.

Subroutine RELY additionally communicates with the main program through the COMMON blocks: USERR, USERI, BTWN, DBCOM,

CHOSE, and PRTCOM. Variables in USERR and USERI are user inputs and are discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE, and OPTION). The variables in BTWN, CHOSE, DBCOM and PRTCOM are discussed in Paragraph 3.2.

5.8.3 Variables Specified in DATA Statements

None

5.8.4 Other Subroutines Called

5.8.4.1 Subroutine RIMOD (J, DELH, ITRUNC, NT, IADD, IOPT

Subroutine RIMOD is called by subroutine RELY. Subroutine RIMOD computes the reliability function for a specified module with or without a redundancy added. Five different models are used, depending on the failure mode of an individual module. The calling parameters are:

J	=	Current module number
DELH	=	Time increment
ITRUNC	=	Number of time points
NT	=	Input option
IADD	=	Input option
IOPT	=	Input option

Parameters passed through COMMON block CHOSE are:

NCHOSE	=	Initial number of elements by module
SYSPAR	=	Matrix of model parameters (called DATAB in subroutine RELY)

Parameters passed through COMMON block DBCOM are:

R	=	Resultant reliability function
NR	=	Number of redundancies by module

5.8.4.2 Subroutine QSF (H, Y, Z, NDIM)

Subroutine QSF is called by subroutine RELY. Subroutine QSF computes a vector of integral values for a given equidistant table of function values. QSF is a member of the System/360 Scientific Subroutine

Package. The calling parameters are:

H	=	Increment of argument values
Y	=	Input vector of function values
Z	=	Resulting vector of integral values
NDIM	=	Dimension of vectors Y and Z

No parameters are passed in common.

5.8.4.3 Subroutine GAM (X)

The function GAM is called by RIMOD. Function GAM computes the gamma function of its argument, X. GAM uses a polynomial approximation on the interval (1.0, 2.0).

5.8.4.4 Subroutine CERF (X)

The function CERF is called by RIMOD. Function CERF computes the error function for X in (0.0, 4.0) and the compliment of the error function for X in (4.0, ∞). A Chebyshev approximation is used in both cases.

5.9 SUBROUTINE THRML (IERR, NCONF)

5.9.1 Purpose of Subroutine

The thermal sizing subroutine determines the phase change material weight, insulation area, heater power, radiator area, and types of heat pipes to be used. Various configurations are considered in the subroutine dependent upon variables such as orbit, shape of vehicle, type of stabilization, power requirements, temperature limits, and battery temperatures. These variables are determined elsewhere in the model and passed to THRML via the common blocks.

The output quantities are computed in the following sequence:

a. Radiator area (RADA)

b. Heater power (HTRPWR)

c. Heat pipe (HTPIPE)

d. Battery radiator area (RADAB)

e. Battery heater power (HTRPRB)

f. Battery variable conductance heat pipe (VCHP)

g. Total radiator area (RAT)

h. Total heater power (HPT)

i. Total heat pipes (HTPT)

5.9.2 Communication with Main Program

Both variables listed in the calling sequence are discussed in Paragraph 3.3.

In addition to the calling sequence, subroutine THRML communicates with the main program via three COMMON blocks: USERI, CHOSE, and BTWN. Variables coming through USERI are user inputs discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE, and OPTION). The variables in BTWN and CHOSE are discussed in Paragraph 3.2.

5.9.3 Variables Specified in DATA Statements

```
DATA SIGMA/0.1714 E-08/, QS/442./, EMISS/60./,
     ALBDO/155./, CONST/1.5/, PIE/3.1416/
```

where:

SIGMA	=	Boltzmann constant in Btu/(hr-ft-deg R^4)
QS	=	Solar constant in Btu/(hr-ft^2)
EMISS	=	Earth emission in Btu/(hr-ft^2)
ALBDO	=	The Albedo in Btu/(hr-ft^2)
CONST	=	The K constant (dimensionless)

5.9.4 Other Subroutines Called

None

5.10 SUBROUTINE COSTS (NCONF, NEQUIP)

5.10.1 Purpose of Subroutine

The cost subroutine determines the cost of building and integrating a payload from the design engineering phase to the launch phase. Costs are broken down into the following categories (variable names are in parenthesis):

DDT&E (Nonrecurring)	Investment (Recurring)
Design engineering (DE)	Unit engineering (PE)
Test and evaluation (TE)	Unit production (PU)
Tooling and equipment (TOOLR)	Tooling and equipment (TOOLU)
Quality control (QCR)	Quality control (QCU)
Systems engineering and integration (SEIR)	Systems engineering and integration (SEIP)
Program management (PMR)	Program management (PMP)

Other costs which are computed are listed in the table below (variable names are written in where computed):

Cost Category	DDT&E	Investment	Operations
Spacecraft	SATR	SATINV	
Mission equipment	XMER	XMEINV	
Total payload	PAYR	PAYINV	
Quality Units	PAYQUL		
GSE	GSE		
Launch support			XLTOT
Flight operations			CTOT
Contractor fee	FEER	FEEINV	FEEOPS
Program total	DDTE	XVEST	OPS

5.10.2 Communication with Main Program

Both variables listed in the calling sequences are discussed in Paragraph 3.3.

In addition to the calling sequence, subroutine COSTS communicates with the main program via five COMMON blocks: USERC, USERI, BTWN, CHOSE, and PRTCOM. Variables coming through USERC are user inputs discussed in Paragraph 8.1 (see NAMELISTs REQUIR, DESIRE, and OPTION). The variables in BTWN, CHOSE, and PRTCOM are discussed in Paragraph 3.2.

5.10.3 Variables Specified in DATA Statements

DATA FR, FP, FT, FE, RE, RT, RP, BE, BT, BP, PI, SF

where:

FR(6)	=	Subsystem design engineering cost factor
FP(6)	=	Subsystem unit production cost factor
FE(6)	=	Subsystem unit engineering cost factor
FT(6)	=	Subsystem test evaluation cost factor
RE(6)	=	Design engineering CER constant
RT(6)	=	Test evaluation CER constant
RP(6)	=	Production CER constant
BE(6)	=	Design engineering CER exponent
BT(6)	=	Test evaluation CER exponent
BP(6)	=	Production CER exponent

The six values in each of the above arrays are associated with the following equipment or systems in the order indicated:

a. Solar array
b. Wiring harness
c. Thermal
d. Converters
e. Propellant feed systems
f. Structures

In addition:

PI	=	Price index (i.e., change of the value of the dollars)
SF	=	Optional factor (e.g., standardization factor)

5.10.4 Other Subroutines Called

None

5.11. SUBROUTINE SKED (NEQUIP, NCONF)

5.11.1 Purpose of Subroutine

The purpose of this subroutine is to calculate component development lead time, subsystem development lead time, component qualification time, subsystem qualification lead time, test lead time, and a total time for each subsystem and for the mission equipment. The critical path is determined and the associated times are passed to the PRNT routine.

5.11.2 Communication with Main Program

Both variables in the calling sequence are discussed in Paragraph 3.3. Subroutine SKED also communicates with the main program via three COMMON areas: CHOSE, USER8, and PRTCOM. Variables coming through USER8 are user inputs discussed in Paragraph 8.1 (See NAMELISTs REQUIR, DESIRE, and OPTION). The variables in BTWN and PRTCOM are discussed in Paragraph 3.2.

5.11.3 Variables Specified in DATA Statements

DATA CONF, ICI

where:

CONF(22, 5) = Configuration dependent weighting factors

ICI(5) = Index with which the CONF array is addressed

5.11.4 Other Subroutines Called

None

5.12 SUBROUTINE PRNT (IERR, NEQUIP, NACCEP, NCONF)

5.12.1 Purpose of Subroutine

This subroutine prints all output determined by the model. A sample of the output may be found in Paragraph 8.3. This sample includes all three possible levels (system, subsystem, assembly) of output which are available as well as a glossary containing descriptive information. Depending on the value of the parameter, IPRINT, system, system plus subsystem or system, subsystem and assembly design information will be printed out for each design.

5.12.2 Communication with Main Program

The variables IERR and NCONF listed in the calling sequence are discussed in Paragraph 3.3. NEQUIP is discussed in Paragraph 3.1. NACCEP is a counter maintained by MAIN and used only by PRNT. It is the acceptable design number identifying the particular run.

In addition to the calling sequence, subroutine PRNT communicates with the main program via five COMMON blocks: BTWN, PRTCOM, CHOSE, USERP, and USERI.

5.12.3 Variables Specified in DATA Statements

None.

5.12.4 Other Subroutines Called

None.

6. DATA BASE

Paragraph 6.1 contains the discussion of the data base, the position of the attributes contained therein, and a description of the data base tape. Paragraph 6.2 discusses the PRESORT program which may reorder the data base prior to exercising the model.

6.1 FORMAT

The data base tape is a seven track, BCD tape, 800 bpi and blocked 84 characters per record. The format is illustrated in Figure 6-1.

Equipments in the data base are ordered by: (1) subsystems, (2) configuration within each subsystem, and (3) equipment types within each configuration [sized equipment(s) first, selected equipment(s) second]. Within equipment types, the equipment is ordered according to the prime technical performance parameter. (This ordering may be changed by the PRESORT routine discussed in Paragraph 6.2.) A list of the data base equipment in the order determined by these considerations is given below:

a. Stabilization and Control

1. Despin mechanical and electronics assembly
2. Valve driver assembly
3. Sun sensor with electronics
4. Nutation damper
5. Gimbal electronics assembly
6. Control timing assembly
7. Biaxial drive assembly
8. Nonscanning earth sensor
9. Sun sensor with electronics
10. Control electronics assembly
11. Rate gyro assembly
12. Horizon sensor
13. Reaction wheel
14. Power converter
15. Attitude reference electronics
16. Valve driver assembly
17. Rate integrating gyros

18. Horizon sensor (with electronics)
19. Electronics processing assembly
20. Single gimbal control moment gyro
21. Star sensor with electronics
22. Electronic error processor

b. Auxiliary Propulsion

1. Cold gas thruster
2. Cold gas isolation valve
3. Cold gas filter
4. Cold gas pressure regulator
5. Cold gas pneumatic tank
6. Cold gas fill and vent valve
7. Cold gas relief valve
8. Monopropellant thruster
9. Monopropellant isolation valve
10. Monopropellant filter
11. Monopropellant spherical tank
12. Monopropellant fill valve
13. Bipropellant thruster
14. Bipropellant isolation valve
15. Bipropellant filter
16. Bipropellant tank
17. Bipropellant fill valve

c. Data Processing and Instrumentation

1. General purpose processor
2. Special purpose processor (digital telemetry unit

d. Communications

1. Base band assembly unit
2. Antenna
3. Transmitters
4. Receiver
5. Signal conditioner
6. Diplexer
7. Converters (transmitter and receiver)

e. Electrical Power

1. Shunt regulator
2. Battery cells
3. Battery charger
4. Discharge regulator
5. Shunt regulator
6. Battery charger

7. Central control unit
8. Series load regulator
9. Battery charger
10. Solar power distributor
11. Power distributor
12. Power control unit

6.2 PRESORT

A small program exists to sort the data base prior to submitting a run for obtaining preliminary spacecraft designs. It will sort the data base according to weight, cost, or reliability. A single digit in Column 1 of a card (to be read on unit 5) determines the sort-variable: 1 = weight (row 23), 2 or 3 = cost (row 46 and 47 or 48), 4 = reliability (row 42). Input tape is expected on unit 8. Output tape is unit 9. Either disk or tape is acceptable for both input and output. Output should be input to the main run. If this presort capability is not used, the order of the data base is determined by technical performance as discussed in Paragraph 6.1.

Identification			
1	ID	E5.0	
2	CO	A2	
3	Type	3A6	
4			Card 1
5			
Technical Characteristics			
6	T.P. 1		
7	2		
8	3	5E10.0	
9	4		
10	5		
11	6		
12	7		
13	8		
14	9		
15	10	8E10.0	Card 2
Performance			
16	Ave Pow		
17	Max Pow		
18	Min Pow		
19	Nom Volt		
20	Max Volt		
21	Min Volt		
22	C or I	8E10.0	Card 3
23	Weight		
24	Volume		
25	Rand Vib		
26	N-Rand		
27	Max Temp		
28	Min Temp		
29	Press		
CDPI Inputs		8E10.0	Card 4
30	No. Pow Cmd		
31	No. Other Cmd		
32	Time Tags		
33	No. Hi 'T' Ana		
34	No. Hi 'T' Dig		

Figure 6-1. Data Base Format (7 Cards/Equipment)

35	Samp Rate	8E10.0	Card 5
36	Granularity		
37	No. Lo 'T' Ana		
38	No. Lo 'T' Dig		
39	Samp Rate		
40	Granularity		
Safety			
41	Fail Mod		
42	λ or μ		
43	σ		
44	q	8E10.0	Card 6
45	Max Redund		
Cost			
46	D. E. Cst		
47	T. E. Cst		
48	Unit Prod		
49	Ref Quant		
50	Factor		
Schedule			
51	Devel Const		
52	Devel Var	5E10.0	Card 7
53	Qual Const		
54	Qual Var		
55	State-Art		

Figure 6-1. Data Base Format (7 Cards/Equipment) (Continued)

7. RESTRICTIONS AND/OR LIMITATIONS

The following tables detail both restrictions and limitations of the model. The first type of restriction is that of incompatibility between subsystem configurations and user requirements (Table 7-1). The second type of restriction is that of incompatibility between subsystem configurations (Tables 7-2 through 7-8).

Table 7-1. Stabilization and Control Configuration Selection

Requirements	Dual Spin	Yaw Spin	Three-Axis Mass Expulsion	ME with CMGs	ME and Momentum Wheel
Orientation					
Inertial	Yes	No	Yes	Yes	Yes
Earth pointing	Yes	Yes	Yes	Yes	Yes
Sun pointing	Yes	No	Yes	Yes	Yes
Maneuverability requirements					
Vehicle slewing	No	Yes	Yes	Yes	No
Pointing accuracy					
35-170 mrad (2-10 deg)	Yes	Yes	Yes	Yes	Yes
3.5-35 mrad (0.2-2 deg)	Yes	Yes	Yes	Yes	Yes
0.17-3.5 mrad (0.01-0.2 deg)	Yes	No	No	Yes	No
$<$ 0.17 mrad ($>$ 0.01 deg)	No	No	No	Yes	No
Rate accuracy					
1.7-17 mrad/sec (0.1-1.0 deg/sec)	Yes	Yes	Yes	Yes	Yes
0.17-1.7 mrad/sec (0.01-0.1 deg/sec)	Yes	Yes	Yes	Yes	Yes
$<$ 0.17 mrad/sec (0.01 deg/sec)	No	No	No	Yes	No

Legend: Yes - Configuration can be used
No - Configuration cannot be used

Table 7-2. Stabilization and Control Configuration Compatibility

Stabilization and Control Subsystem Configurations	Data Processing Subsystem	
	General Purpose Processors	Special Purpose Processors
Dual Spin	Yes	Yes
Yaw Spin	Yes	Yes
Three-Axis Mass Expulsion	Yes	Yes
Mass Expulsion with Control Moment Gyros	Yes	No
Mass Expulsion with Pitch Momentum Wheel	Yes	Yes

Legend:
- Yes - Compatible
- No - Incompatible

Table 7-3. Auxiliary Propulsion Configuration Selection

Input Requirements	Cold Gas	Monopropellant	Bipropellant
Thrust			
< 224 newtons (< 50 lb)	Yes	Yes	Yes
224-4450 newtons (50-1000 lb)	No	Yes	Yes
> 4450 newtons (> 1000 lb)	No	No	Yes
Total Impulse			
< 4.4×10^4 newton-sec (< 10^4 lb-sec)	Yes	No	No
4.4×10^4 - 2.2×10^5 newton-sec (10^4 - 5×10^4 lb-sec)	Yes	Yes	No
2.2×10^5 - 8.9×10^5 newton-sec (5×10^4 - 2×10^5 lb-sec)	No	Yes	Yes
> 8.9×10^5 newton-sec (2×10^5 lb-sec)	No	No	Yes

Legend:

Yes - Acceptable

No - Unacceptable

Table 7-4. Data Processing Configuration Compatibility

Communication Configuration	General Purpose Processor	Special Purpose Processors	
		1 DTU	2 DTUs
Uplink, plus downlink	Yes (1 Data Rate Computed)	Yes	No
Unified link, common antenna	Yes (1 Data Rate Computed)	Yes	No
Unified link, separate antennas	Yes (1 Data Rate Computed)	Yes	No
Unified link, common antenna plus downlink	Yes (2 Data Rates Computed)	No	Yes
Unified link, separate antennas plus downlink	Yes (2 Data Rates Computed)	No	Yes

Legend:
Yes - Compatible
No - Incompatible

Table 7-5. Communication Configuration Selection

Configurations	Ranging Requirement
Uplink plus downlink	No
Unified link, common antenna	Yes
Unified link, separate antennas	Yes
Unified link, common antenna plus downlink	Yes
Unified link, separate antennas plus downlink	Yes

Legend:

Yes - Acceptable

No - Unacceptable

Table 7-6. Electrical Power Configuration Compatibility

Configuration	Vehicle Orientation	
	Spinning	Nonspinning
Solar Arrays		
Body Mounted	Yes	Yes
Oriented Paddles	No	Yes

Legend:
Yes - Compatible
No - Incompatible

Table 7-7. Vehicle Shape Compatibility

SANDC Configuration	Cylinder	Sphere	Box
Spinning	Yes	Yes	No
3-Axis	Yes	Yes	Yes

Legend:
Yes - Compatible
No - Incompatible

Table 7-8. Structural Configuration Compatibility

Structural Configuration	Vehicle Shape		
	Cylinder	Sphere	Box
Monocoque	Yes	No	Yes
Semi-Monocoque	Yes	No	Yes
Truss	Yes	Yes	Yes

Legend:
Yes - Compatible
No - Incompatible

8. SAMPLE TEST CASE

Paragraph 8.1 discusses the input variables to the model. Paragraph 8.2 discusses values that were used in the sample test case. Paragraph 8.3 contains the results of the sample test case.

8.1 USER INPUT VARIABLE LIST

Inputs to the model are listed in Table 8-1. NAMELIST names are shown in parenthesis. All NAMELIST blocks must be in the order given. If the user wishes to use the default parameters, the variables need not be entered. However, NAMELIST control input must exist for each NAMELIST section. For example:

```
Title Card (80 columns)
$ REQUIR
     .
     .
     .
$ END
$ DESIRE
     .
     .
     .
$ END
$ OPTION
     .
     .
     .
$ END
```

8.2 INPUT VARIABLES FOR TEST CASE

Figure 8-1 lists the variables which were used for the sample test case. Only those variables that are changed from the default values need to be entered.

Table 8-1. User Input List

Required Input Data

FORTRAN Name	Default Value	Units	Description
MICRO	0		Set to 0 for macro; set to 1, 2, 3, 4 or 5 for micro. If 0, program operates in macro mode. If 1, 2, 3, 4, or 5, program performs micro search for SANDC, AUXPRO, DPI, COMM, or EP subsystems, respectively. For micro search on a specific subsystem, user must restrict all other subsystems to one configuration each.
IPRINT	1		Set to 1 for system level printout. Set to 2 for system and subsystem level printouts. Set to 3 for system, subsystem, and assembly level printouts. Zero allows no printout.
T	24.	mo	Mission lifetime
APOGEE	500.	nmi	Orbit apogee
PERIGE	500.	nmi	Orbit perigee
SPEC1 *	18	mo	System mean mission duration requirement
SPEC6 *	0.6		System reliability requirement at end of mission life.
NQV	1		Number of qualification vehicles
NFV	4		Number of flight vehicles
EQM1WT	435.	lb	Mission equipment weight (must be zeroed out if there is no mission equipment one)
EQM2WT	435.	lb	Mission equipment weight (must be zeroed out if there is no mission equipment two)
EPME	200.	watts	Mission equipment power requirement

*Either SPEC 1 or SPEC 6 can be omitted if the other is given. If SPEC 1 $\leq$ 0.1, the requirement is ignored, thereby reducing the execution time of the program. If SPEC 6 $\leq$ 0.00001, this requirement is ignored; however, the program execution time is not reduced.

Table 8-1. User Input List (Continued)

Desirable Input Data

FORTRAN Name	Default Value	Units	Description
IAGNCY	1		1 = USAF, 2 - NASA
IMETYP	2		Mission equipment type (1 means Communications, 2 means Earth Observation, 3 means Lunar, 4 means Planetary)
ISATOR	1		1 earth oriented, 2 sun oriented, 3 inertially oriented
PHIRX	0.75	deg	Required attitude accuracy about roll, pitch, and yaw axes
PHIRY	0.75	deg	
PHIRZ	0.75	deg	
NMSEQ	1		Number of mission equipment command and telemetry data arrays in ARRAYN (maximum of 3)
			Mission data for up to three (3) equipments *
ARRAYN (1, -)	(0., 0., 0.)		Power switching command
ARRAYN (2, -)	(0., 0., 0.)		Other commands
ARRAYN (3, -)	(0., 0., 0.)		Time tagged commands
			High rate telemetry **
ARRAYN (4, -)	(106., 0., 0.)		Number of analog points
ARRAYN (5, -)	(106., 0., 0.)		Number of digital points
ARRAYN (6, -)	(500., 0., 0.)	sec^{-1}	Sample rate
ARRAYN (7, -)	(8., 0., 0.)	bits	Word length
			Low rate telemetry **
ARRAYN (8, -)	(280., 0., 0.)		Number of analog points
ARRAYN (9, -)	(280., 0., 0.)		Number of digital points
ARRAYN (10, -)	(1., 0., 0.)	sec^{-1}	Sample rate
ARRAYN (11, -)	(8., 0., 0.)	bits	Word length
OPSMS	0.	ops/sec	Number of mission operations
MB12SH	1		Mission equipment bay shape (1 means cylinder, 2 means box)
EQM1XL	(Calculated)	in.	No. 1 mission equipment bay length ***
EQM1YL	(Calculated)	in.	No. 1 mission equipment bay width ***
EQM1ZL	(Calculated)	in.	No. 1 mission equipment bay height ***
EQM2XL	(Calculated)	in.	No. 2 mission equipment bay length ***
EQM2YL	(Calculated)	in.	No. 2 mission equipment bay width ***
EQM2ZL	(Calculated)	in.	No. 2 mission equipment bay height ***

* Representative values shown for ARRAYN apply to the separate downlink configurations. Designs not using a separate downlink for the mission equipment should specify substantially smaller input values than those values suggested since the mission equipment data is combined with the housekeeping data for transmission purposes.

** For separate downlink designs, nonzero high rate and low rate telemetry data must be specified for at least one mission equipment. Designs not using a separate downlink for the mission equipment can have ARRAYN zeroed out.

*** Must be zeroed out if not used.

Table 8-1. User Input List (Continued)

Desirable Input Data

FORTRAN Name	Default Value	Units	Description
EM1YCG	0.	in.	Mission equipment CGs relative to equipment bay interface
EM1ZCG	0.	in.	
EM2YCG	0.	in.	
EM2ZCG	0.	in.	
NUMEEQ	0		Number of external equipments (Maximum of 9)
EEQWT(1)	0.	lb	External equipment weights
EEQWT(2)	0.	lb	
EEQWT(3)	0.	lb	
EEQWT(4)	0.	lb	
EEQWT(5)	0.	lb	
EEQWT(6)	0.	lb	
EEQWT(7)	0.	lb	
EEQWT(8)	0.	lb	
EEQWT(9)	0.	lb	
EEQVL(1)	0.	ft^3	External equipment volumes
EEQVL(2)	0.	ft^3	
EEQVL(3)	0.	ft^3	
EEQVL(4)	0.	ft^3	
EEQVL(5)	0.	ft^3	
EEQVL(6)	0.	ft^3	
EEQVL(7)	0.	ft^3	
EEQVL(8)	0.	ft^3	
EEQVL(9)	0.	ft^3	
CGEEX(1)	2.		Location of external equipment (1 means front, 2 means center, 3 means aft end along axis of symmetry)
CGEEX(2)	2.		
CGEEX(3)	2.		
CGEEX(4)	2.		
CGEEX(5)	2.		
CGEEX(7)	2.		
CGEEX(8)	2.		
CGEEX(9)	2.		
EELOC(1)	3.		Location of external equipment (1 means right, 2 means left, 3 means top, 4 means bottom-looking along the axis of symmetry from the aft end)
EELOC(2)	3.		
EELOC(3)	3.		
EELOC(4)	3.		
EELOC(5)	3.		
EELOC(6)	3.		
EELOC(7)	3.		
EELOC(8)	3.		
EELOC(9)	3.		

Table 8-1. User Input List (Continued)

Desirable Input Data

FORTRAN Name	Default Value	Units	Description
RELME	1.0		Mission equipment reliability at end of mission life
XMER	0.	$	Mission equipment DDT&E cost
XMEU	0.	$	Mission equipment average unit cost
PI	1.0		Price index factor
			Schedule data for up to three mission equipment:
SKDME(1, -)	(0., 0., 0.)	$1000	Design engineering cost
SKDME(2, -)	(0., 0., 0.)	$1000	Test and evaluation cost
SKDME(3, -)	(0., 0., 0.)	mo	Development lead time constant
SKDME(4, -)	(0., 0., 0.)	mo	Development lead time variable
SKDME(5, -)	(0., 0., 0.)	mo	Qualification lead time constant
SKDME(6, -)	(0., 0., 0.)	mo	Qualification lead time variable
SKDME(7, -)	(0., 0., 0.)		State-of-art factor

Table 8-1. User Input List (Continued)

Optional Input Data

FORTRAN Name	Default Value	Units	Description
IDEBUG	0		Input value of 1 causes cost and reliability debugging information to be printed out.
ISTRT1	1		First of all allowable five configurations to be designed for the Stabilization and Control subsystem. ISTRTI and IENDI effectively limit the number of configurations whose designs will be attempted. (Must be equal for micro search on another subsystem).
IEND1	5		Last of the allowable five configurations to be designed for the Stabilization and Control subsystem.
ISTRT2 IEND2	1 3		As above for Auxiliary Propulsion
ISTRT3 IEND3	1 2		As above for Data Processing and Instrumentation
ISTRT4 IEND4	1 5		As above for Communications
ISTRT5 IEND5	1 6		As above for Electrical Power
ISTRT6 IEND6	1 3		As above for Vehicle Sizing
ISTRTR IENDR	0 1		As above for Reliability
ORBINC	(Calculated)	deg	Orbit inclination
DPHI	.25	deg	Main engine alignment to thrust axis
FE	4.1	lb	Translational thrust (must be non-zero)
TSMALL	100.	sec	Main engine burn time (ΔV and stationkeeping)
XNU	3.		Control system efficiency
PDOT0	1.	deg/sec	Maximum initial rate
PDOTX PDOTY PDOTZ	1. 1. 1.	deg/sec	Maximum maneuver rates
XN YN ZN	1. 1. 1.		Number of maneuvers about roll, pitch, and yaw axes

Table 8-1. User Input List (Continued)

Optional Input Data

FORTRAN Name	Default Value	Units	Description
PDOTRX PDOTRY PDOTRZ	.012 .012 .012	deg/sec	Required system rate accuracy
TPMIN	10.0	sec	Minimum payload scan period (applies only to yaw spin configuration)
OMEGR	(Calculated)	rpm	Spin rate of rotor (applies only to dual spin configuration)
XNN	(Calculated)	days	Time between spin axis corrections (applies only to dual spin configuration)
K	1		0 if errors for spin axis relative to nadir; 1 if errors for payload relative to nadir (applies only to dual spin configuration)
MANV	1		4 means vehicle skewing and prevents design of the dual spin configuration; otherwise, no effect
EP1	.0001	deg/sec	Maximum programmed pitchover rate (applies only to three-axis mass expulsion configuration)
AX AY AZ	.05 .05 .05	deg	Misalignment errors in mounting inertia measurement units (applies only to three-axis mass expulsion configuration)
EA	0.10	deg	Antenna misalignment (applies only to pitch momentum bias configuration)
EANT	0.1	rad	Antenna elevation (applies only to pitch momentum bias configuration and should be set to less than one radian)
ALPHA	12.0	deg	Thruster offset in roll-yaw plane (applies only to pitch momentum bias configuration)
TL	1.0	day	Time between unloading wheel momentum (applies only to CMG configuration)
TACCEL	(Calculated)	sec	Acceleration time for maneuvering (applies only to CMG configuration)
XNNN	4.0		Number of single gimbaled gyros (applies only to CMG configuration)
THOLD	100000.	min	Time vehicle in inertial hold (applies only to CMG configuration)
PDOTAV	0.01	deg/sec	Average body rate for low orbit when high accuracy is required (applies only to CMG configuration)

Table 8-1. User Input List (Continued)

Optional Input Data

FORTRAN Name	Default Value	Units	Description
PDOTST	0.0667	deg/sec	Maximum rate at which star information is obtained (applies only to CMG configuration)
THETMX	180.	deg	Maximum maneuver angle (applies only to CMG configuration)
PHIFOV	40.0	deg	Maximum range of attitude freedom required to track specific stars (applies only to CMG configuration)
BTRMX	1.024×10^6	bit/sec	Maximum bit rate
SCSFL	0.		Special command synchronization flag (0 means no synchronization required, 1 means synchronization required)
TPRFL	0.		Telemetry processing flag (0 means telemetry processed separately, 1 means otherwise)
IOPTCM	0		Ranging requirement (0 or 1 for no or yes)
LINK	1		Communications link (0 or 1 for USB or SGLS) *
FREQ(2)	2250., 2250	MHz	Frequency of downlink transmitters (second number refers to separate down-link)
NET	1		1 = NASA net, 0 = AFSCF net
NADIR	0		Nadir coverage flag (0 = no, 1 = yes)
FREQR	1800.	MHz	Receiver frequency
COMRAT	1000.	baud	Receiver command rate
BWIDTH(2)	(Calculated)**	Hz	Bandwidth for transmitter (default values are flags that cause bandwidth to be computed as a function of bit rate)
OPTEMP	15.	°C	Battery temperature
EQPF	5.		Volume sizing factor
ISBOFG	0		Solar array boom drive requirement (0 means not required, 1 means required)
XCGSA1	1.		Location of solar paddles (1 means front, 2 means center, 3 means aft end)

* The computer program does not currently possess the ability to design an USB communications link.

** In Subroutine COMM

Table 8-1. User Input List (Continued)

Optional Input Data

FORTRAN Name	Default Value	Units	Description
XCGSA3	1.		Location of body mounted solar array (1 means front, 2 means center, 3 means aft end)
DIAMAX	120.	in.	Maximum satellite diameter
RFIXED	1.0		Initial system reliability
KEOPT	1		Expense option indicator (1 means additional redundancy is penalized on the basis of weight; otherwise expense is cost)
SLBMX	50000.0	lb	Maximum system weight
ISPT	0		Single point failure requirements option (0 = not in effect, otherwise in effect)
ISUB	0		Subsystem requirements option (= at least one subsystem has a reliability spec, otherwise no reliability specs on subsystem)
SPEC(1)*	(Calculated)		Reliability requirement for the Stabilization and Control subsystem
SPEC(2)*	(Calculated)		Reliability requirement for the Auxiliary Propulsion subsystem
SPEC(3)*	(Calculated)		Reliability requirement for the Data Processing subsystem
SPEC(4)*	(Calculated)		Reliability requirement for the Communication subsystem
SPEC(5)*	(Calculated)		Reliability requirement for the Electrical Power Subsystem
CA	10.	g	Axial launch acceleration
CE	5.	g	Lateral launch acceleration
FEEPCT	0.07		Contractor's fee percentage

* If SPEC(K) $\leq$ 0.00001, the requirement for the Kth subsystem is ignored.

```
$REQUIR
APOGEE  =  0.193229E+05,
EPME    =  0.3E+03,
EQM1WT  =  0.181E+03,
EQM2WT  =  0.0,
IPRINT  =  3,
MICRO   =  0,
NFV     =  6,
NQV     =  1,
PERIGE  =  0.193229E+05,
SPEC1   =  0.38E+02,
SPEC6   =  0.236E+00,
T       =  0.6E+02,
$END
```

Figure 8-1. Input Variables for Test Case

```
$DESIRE
ARRAYN  =  0.16E+02,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.68E+02,  0.16E+02,  0.75E-02,  0.8E+01,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
           0.0,  0.0,  0.0,  0.0,  0.0,
CGEEX   =  0.2E+01,  0.2E+01,  0.2E+01,  0.2E+01,  0.2E+01,  0.2E+01,  0.2E+01,  0.2E+01,  0.2E+01,
EELOC   =  0.3E+01,  0.3E+01,  0.3E+01,  0.3E+01,  0.3E+01,  0.3E+01,  0.3E+01,  0.3E+01,  0.3E+01,
EEQVL   =  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
EEQWT   =  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
EM1YCG  =  0.0,
EM1ZCG  =  0.0,
EM2YCG  =  0.0,
EM2ZCG  =  0.0,
EQM1XL  =  0.484E+02,
EQM1YL  =  0.1082E+03,
EQM1ZL  =  0.1082E+03,
EQM2XL  =  0.0,
EQM2YL  =  0.0,
EQM2ZL  =  0.0,
IAGNCY  =  1,
IKETYP  =  1,
ISATOR  =  1,
NB12SH  =  1,
NMSEQ   =  1,
NUMEEQ  =  0,
OPSMS   =  0.0,
PHIRX   =  0.393E+00,
PHIRY   =  0.393E+00,
PHIRZ   =  0.393E+00,
PI      =  0.1E+01,
RELME   =  0.7E+00,
```

Figure 8-1. Input Variables for Test Case (Continued)

```
SKDME    =  0.0,  0.0,  0.(,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,     0.0,  0.0,  0.0,  0.0,  0.0,
            0.0,  0.0,  0.(,  0.0,  0.0,
XMER     =  0.323E+08,
XMEU     =  0.334E+07,
$END
```


Figure 8-1. Input Variables for Test Case (Continued)

```
$OPTION
ALPHA    =  0.12E+02,
AX       =  0.5E-01,
AY       =  0.5E-01,
AZ       =  0.5E-01,
BTRMX    =  0.1024E+07,
BWIDTH   = -0.1E+11, -0.1E+11,
CA       =  0.1E+02,
CE       =  0.5E+01,
COMRAT   =  0.1E+04,
DIAMAX   =  0.108E+03,
DPHI     =  0.25E+00,
EA       =  0.1E+00,
EANT     =  0.1E+00,
EP1      =  0.1E-03,
EQPF     =  0.1E+02,
FE       =  0.35E+01,
FEEPCT   =  0.7E-01,
FREQ     =  0.225E+04,  0.225E+04,
FREQR    =  0.18E+04,
IEND1    =  1,
IDEBUG   =  1,
IEND2    =  2,
IEND3    =  2,
IEND4    =  2,
IEND5    =  2,
IEND6    =  1,
IENDR    =  0,
ICPTCM   =  1,
```

Figure 8-1. Input Variables for Test Case (Continued)

```
ISBOFG  =  0,
ISPT    =  0,
ISTRT1  =  1,
ISTRT2  =  2,
ISTRT3  =  2,
ISTRT4  =  2,
ISTRT5  =  2,
ISTRT6  =  1,
ISTRTR  =  0,
ISUB    =  0,
K       =  1,
KEOPT   =  1,
LINK    =  1,
MANV    =  1,
NADIR   =  1,
NET     =  0,
OMEGR   =  0.58E+02,
OPTEMP  =  0.15E+02,
ORBINC  =  0.25E+01,
PDOTAV  =  0.1E-01,
PDOTRX  =  0.12E-01,
PDOTRY  =  0.12E-01,
PDOTRZ  =  0.12E-01,
PDOTST  =  0.667E-01,
PDOTX   =  0.1E+01,
PDOTY   =  0.1E+01,
PDOTZ   =  0.1E+01,
PDOTO   =  0.1E+01,
```

Figure 8-1. Input Variables for Test Case (Continued)

```
PHIFOV  =  0.4E+02,
RFIXED  =  0.1E+01,
SCSFL   =  0.0,
SLBMX   =  0.265E+04,
SPEC    =  0.77960195333414E+00,  0.90469088846678E+00,  0.80754398745401E+00,  0.77960195333414E+00,  0.877
           0.236E+00,
TACCEL  =  0.18E+02,
THETMX  =  0.18E+03,
THOLD   =  0.1E+06,
TL      =  0.1E+01,
TFMIN   =  0.1E+02,
TPRFL   =  0.0,
TSMALL  =  0.717E+02,
XCGSA1  =  0.1E+01,
XCGSA3  =  0.2E+01,
XN      =  0.1E+01,
XNN     =  0.1E+02,
XNNN    =  0.4E+01,
XNU     =  0.3E+01,
YN      =  0.1E+01,
ZN      =  0.1E+01,
$END
```

Figure 8-1. Input Variables for Test Case (Continued)

8.3 SAMPLE TEST CASE RESULTS

The test case corresponds to the DSCS-II satellite. This satellite provides for expanded communications service for worldwide military installations and the National Command Authority. The satellite is drum-shaped. Two dish antennas on top of the spacecraft are deployed in orbit to provide narrow beam coverage. Conical horn earth coverage antennas are mounted on top of the spacecraft. An omnidirectional command and telemetry antenna is deployed beneath the main body. Communications equipment is mounted on a mechanically despun platform. Other subsystems are housed in the main body of the spacecraft. The test case results are presented in Figure 8-2.

```
DEFINITIONS - -
  CONFIGURATIONS (NCONF)
    STABILIZATION AND CONTROL (NCONF(1))
      NCONF(1)=1 IS DUAL SPIN
      NCONF(1)=2 IS YAW SPIN
      NCONF(1)=3 IS MASS EXPULSION
      NCONF(1)=4 IS MASS EXPULSION W/ CMG-S
      NCONF(1)=5 IS MASS EXPULSION W/ M.W.-S
    DATA PROCESSING AND INSTRUMENTATION (NCONF(3))
      NCONF(3)=1 IS GENERAL PURPOSE PROCESSOR
      NCONF(3)=2 IS SPECIAL PURPOSE PROCESSOR
    ELECTRICAL POWER (NCONF(5))
      NCONF(5)=1 IS SHUNT REGULATION - PADDLE MTD.
      NCONF(5)=2 IS SHUNT REGULATION - BODY MTD.
      NCONF(5)=3 IS SHNT + DISCH.REG - PADDLE MTD.
      NCONF(5)=4 IS SHNT + DISCH.REG - BODY MTD.
      NCONF(5)=5 IS SERIES LOAD REG. - PADDLE MTD.
      NCONF(5)=6 IS SERIES LOAD REG. - BODY MTD.

    AUXILIARY PROPULSION (NCONF(2))
      NCONF(2)=1 IS COLD GAS
      NCONF(2)=2 IS MONOPROPELLANT
      NCONF(2)=3 IS BIPROPELLANT
    COMMUNICATIONS (NCONF(4))
      NCONF(4)=1 IS SEPARATE UPLINK AND DOWNLINK
      NCONF(4)=2 IS UNIFIED LINK-COMMON ANTENNAS
      NCONF(4)=3 IS UNIFIED LINK-SEPARATE ANTENNAS
      NCONF(4)=4 IS UNIFIED LINK-COMMON ANT + DOWNLINK
      NCONF(4)=5 IS UNIFIED LINK-SEPARATE ANT + DOWNLINK
    VEHICLE SIZING (NCONF(6))
      NCONF(6)=1 IS CYLINDER
      NCONF(6)=2 IS BOX
      NCONF(6)=3 IS SPHERE
    RELIABILITY
      REDUNDANCY CONFIGURATION = 0 IS SINGLE SYSTEM
      REDUNDANCY CONFIGURATION = 1 IS DUAL SYSTEM

  MESSAGES (IERR)
    STABILIZATION AND CONTROL
      IERR =     0 MEANS NC MESSAGES
      IERR =     1 MEANS MAX ALLOWABLE SYS. ERROR UNSAT.
      IERR =    1X MEANS MAX RATE ERROR TOO SMALL
      IERR =   1XX MEANS 3-AXIS WHEELS ACCEPTABLE
      IERR =  1XXX MEANS DBL GIMB.CMGS ACCEPTABLE
    DATA PROCESSING AND INSTRUMENTATION
      IERR =     0 MEANS NO MESSAGES
      IERR =     1 MEANS MUX REQUIRED
      IERR =    10 WORD LENGTH GREATER THAN 256
      IERR =   100 BIT RATE IS TOO LARGE
      IERR =  1000 SPEC.CCMD.SYNC.FLG NE 0
      IERR = 10000 END OF DATA BASE SENSED
    VEHICLE SIZING
      IERR = 0 MEANS NO MESSAGES
      IERR = 1 MEANS BODY MOUNTED SOLAR ARRAY LENGTH
               EXCEEDS EQUIPMENT BAY LENGTH

    AUXILIARY PROPULSION
      IERR =  0 MEANS NO MESSAGES
      IERR =  1 MEANS CYCLE LIFE OF ATTITUDE CONTROL
                      THRUSTERS IS TOO SHORT
      IERR = 10 MEANS CYCLE LIFE OF TRANSLATIONAL THRUSTER
                      IS TOO SHORT
      IERR = 11 MEANS CYCLE LIVES OF BOTH THRUSTERS ARE
                      TOO SHORT
    THERMAL
      IERR = 1XXXXXXXXX MEANS BATT RAD AREA IS SUPPLIED
                        IN RADAB
      IERR = X1XXXXXXXX MEANS OSR CONV. AND VARIABLE COND
                        UCTANCE HEAT PIPE INFO IS REQUIRED
      IERR = XX1XXXXXXX MEANS PHASE CONTROL MASS IS
                        SUPPLIEC IN PCM
      IERR = XXX1XXXXXX MEANS ISOTHERMALIZER IS REQUIRED
      IERR = XXXX1XXXXX MEANS DIODE HEAT PIPE IS REQUIRED
                        (2 REQUIRED)
      IERR = XXXXX1XXXX MEANS CONV. HEAT PIPE IS REQUIRED
      IERR = XXXXXX1XXX MEANS OSR RADIATOR IS REQUIRED
      IERR = XXXXXXX1XX MEANS CONV. RADIATOR IS REQUIRED
      IERR = XXXXXXXX1X MEANS HEATER POWER IS SUPPLIED
                        IN HTRPWR
      IERR = XXXXXXXXX1 MEANS RADIATOR AREA IS SUPPLIED
                        IN RADA
```

Figure 8-2. Sample Test Case Results

```
          DSCS-II
* * * *   SYSTEM DESCRIPTICN - - DESIGN NUMBER   1 * * * *
            STABILIZATION AND CONTROL
              CONFIGURATION - - DUAL SPIN
                POINTING ACCURACY =      .393000(DEG.)
            AUXILIARY PROPULSION
              CONFIGURATION - - MONOPROPELLANT
                TOTAL IMPULSE =        20276.(LB-SEC)
            DATA PROCESSING AND INSTRUMENTATION
              CONFIGURATION - - SPECIAL PURPOSE PROCESSOR (DTU)
                COMPUTER OPERATICNS RATE =            0.(IPS)
                CDPI TABLE                                          ENGINEERING DATA    MISSION EQUIPMENT DATA
                  NUMBER OF COMMANDS                                            256.                      0.
                  NUMBER OF MAIN FRAME WORDS                                     64.                      0.
                  MAIN FRAME SAMPLE RATE                                          1.                      0.
                  MAIN FRAME WORD LENGTH                                          8.                      0.
                  NUMBER OF SUBFRAMES                                             8.                      0.
                  SUBFRAME RATE                                                   1.0000                  0.0000
                  NUMBER OF WORDS PER SUBFRAME                                   32.                      0.
            COMMUNICATIONS
              CONFIGURATION - - UNIFIED LINK-COMMON ANTENNAS
                PRIMARY DOWNLINK DATA RATE =          1.000(KBPS)
                SEPARATE DOWNLINK DATA RATE =         0.000(KBPS)
            ELECTRICAL PCWER
              CONFIGURATION - - SHUNT - BODY MOUNTED SOLAR ARRAY
                END OF LIFE POWER REQUIREMENT     =     443.40(WATTS)
                TOTAL SOLAR ARRAY AREA            =     183.07(FT**2)
                MINIMUM INSTALLEC BATTERY CAPACITY=      22.28(AMP-HR)
            VEHICLE SIZING
              CONFIGURATICN - - CYLINDER
                VEHICLE WEIGHT =       1185.68(LBS)  LAUNCH WEIGHT =     1199.91(LBS)
                EQUIPMENT BAY DIMENSIONS LENGTH        77.70(IN),HEIGHT      108.00(IN),WIDTH      108.00(IN)
                MISSION EQUIPMENT LENGTH        48.40(IN),HEIGHT      108.20(IN), WIDTH      108.20(IN)
                TOTAL SATELLITE LENGTH       126.10(IN)
                MOMENTS OF INERTIA(LB-IN**2) IXX=  2027644.1 IYY=  2676386.5 IZZ=  2676386.5
```

Figure 8-2. Sample Test Case Results (Continued)

SAFETY

CONFIGURATION - - SINGLE SYSTEM

MEAN MISSICN DURATION	40.5(MO)
RELIABILITY	.305
MISSION LIFETIME	60.8(MO)

COSTS (ALL AMOUNTS ARE IN DOLLARS)

	DDT+E		INVESTMENT (RECURRING)
DESIGN ENGINEERING	8535559.4	UNIT ENGINEERING	2544648.9
TEST AND EVALUATION	5014470.4	UNIT PRODUCTICN	2223816.5
TOOLING ANC TEST EQUIPMENT	0.0	TOOLING AND TEST EQUIP.	0.0
QUALITY CONTROL	830059.3	QUALITY CONTRCL	349504.0
SYSTEMS ENGINEERING AND INTEGRATION	4085286.0	SYSTEMS ENG. AND INT.	1303527.3
PROGRAM MANAGEMENT	1722045.7	PROGRAM MANAGEMENT	527959.6

COST CATEGORY	DDT+E	INVESTMENT	OPERATIONS
SPACECRAFT	20187420.8	41696738.0	
MISSION EQUIPMENT	32300000.0	20040000.0	
TOTAL PAYLOAD	52487420.8	61736738.0	
QUALIFICATION UNITS	10289456.3		
G.S.E.	1213034.8		
LAUNCH SUPPORT			2156736.5
CONTRACTOR FEE	1984493.8	2918771.7	150971.6
PROGRAM TOTALS	65974405.8	64655509.6	2307708.1

SCHEDULE

COMPONENT DESIGN DEVELOPMENT TIME	14.4(MONTHS)
COMPONENT QUALIFICATION TIME	14.1(MONTHS)
SUBSYSTEM DEVELOPMENT TIME	9.2(MONTHS)
SUBSYSTEM QUALIFICATION TIME	8.1(MONTHS)
SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME	9.2(MONTHS)
SCHEDULE DURATION (TO LAUNCH)	41.0(MONTHS)

Figure 8-2. Sample Test Case Results (Continued)

```
         DSCS-II
* * * *  SUBSYSTEM DESCRIPTIONS - - DESIGN NUMBER    1 * * * *
           STABILIZATION AND CONTROL
             CONFIGURATION - - DUAL SPIN
             EQUIPMENT CODE IDENTIFIER  151  252  352  451  551  651  751  801 1401
             EQUIPMENT QUANTITIES         2    1    2    1    1    2    2    2    2
                       WEIGHT       148.13(LB), VOLUME         5.64(FT**3), POWER REQUIREMENT        57.1(WATT)
                       DES. ENG. COST     2794500.0            TEST + EVAL. COST      1618200.0
                       UNIT PROD.COST      570587.4            UNIT ENG.    COST       989741.2
                       RELIABILITY            .7109
                       SCHEDULE
                         COMPONENT DEVELOPMENT TIME  14.4(MONTH)  COMPONENT QUALIFICATION TIME  14.1(MONTH)
                         SUBSYSTEM DEVELOPMENT TIME   9.2(MONTH)  SUBSYSTEM QUALIFICATION TIME   8.1(MONTH)
                         SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME   9.2(MONTH)
                       IERR              0
           AUXILIARY PROPULSION
             CONFIGURATION - - MONOPROPELLANT
             EQUIPMENT CODE IDENTIFIER  807  807  902 1001  459  201 1102  503  701 1201  601
             EQUIPMENT QUANTITIES         6    2    5    9    2    1    8    1    2    2    2
                       WEIGHT       208.07(LB), VOLUME         5.22(FT**3), POWER REQUIREMENT         8.0(WATT)
                       DRY WEIGHT      86.82(LBS), EXPENDABLE WEIGHT       121.25(LBS)
                       DES. ENG. COST     1004897.4            TEST + EVAL. COST       644989.6
                       UNIT PROD.COST      288305.2            UNIT ENG.    COST       372322.0
                       RELIABILITY            .7789
                       SCHEDULE
                         COMPONENT DEVELOPMENT TIME   4.3(MONTH)  COMPONENT QUALIFICATION TIME   1.6(MONTH)
                         SUBSYSTEM DEVELOPMENT TIME   8.9(MONTH)  SUBSYSTEM QUALIFICATION TIME   7.3(MONTH)
                         SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME   8.9(MONTH)
                       IERR             11
           DATA PROCESSING AND INSTRUMENTATION
             CONFIGURATION - - SPECIAL PURPOSE PROCESSOR (DTU)
             EQUIPMENT CODE IDENTIFIER  201
             EQUIPMENT QUANTITIES         2
                       WEIGHT        20.80(LB), VOLUME         2.00(FT**3), POWER REQUIREMENT         6.0(WATT)
                       DES. ENG. COST      210000.0            TEST + EVAL. COST        97000.0
                       UNIT PROD.COST       59851.8            UNIT ENG.    COST        77893.0
                       RELIABILITY            .8750
                       SCHEDULE
                         COMPONENT DEVELOPMENT TIME   8.9(MONTH)  COMPONENT QUALIFICATION TIME   2.0(MONTH)
                         SUBSYSTEM DEVELOPMENT TIME   2.4(MONTH)  SUBSYSTEM QUALIFICATION TIME   7.1(MONTH)
                         SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME   2.4(MONTH)
                       IERR              1
```

Figure 8-2. Sample Test Case Results (Continued)

```
COMMUNICATIONS
  CONFIGURATION - - UNIFIED LINK-COMMON ANTENNAS
  EQUIPMENT CODE IDENTIFIER  101  201  301  401  502  601  701  702
  EQUIPMENT QUANTITIES         2    1    2    2    2    1    2    2
            WEIGHT         29.45(LB), VOLUME          7.82(FT**3), POWER REQUIREMENT        72.3(WATT)
            DES. ENG. COST       381000.0           TEST + EVAL. COST          416000.0
            UNIT PROC.COST       201216.1           UNIT ENG.    COST          113450.1
            RELIABILITY             .9728
            SCHEDULE
              COMPONENT DEVELOPMENT TIME  16.7(MONTH) COMPONENT QUALIFICATION TIME  10.0(MONTH)
              SUBSYSTEM DEVELOPMENT TIME   2.8(MONTH) SUBSYSTEM QUALIFICATION TIME   7.2(MONTH)
              SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME   2.8(MONTH)
            IERR        0
ELECTRICAL POWER
  CONFIGURATION - - SHUNT - BODY MOUNTED SOLAR ARRAY
  EQUIPMENT CODE IDENTIFIER  101  211  359 1201
  EQUIPMENT QUANTITIES        10    2    2    1
            WEIGHT        183.20(LB), VOLUME         10.93(FT**3), POWER REQUIREMENT        -.0(WATT)
            HARNESS WEIGHT          97.6(LBS), SOLAR ARRAY WEIGHT        127.5(LBS)
            DES. ENG. COST      2693868.5           TEST + EVAL. COST         1549254.4
            UNIT PROC.COST       864986.3           UNIT ENG.    COST          665812.5
            RELIABILITY             .9246
            SCHEDULE
              COMPONENT DEVELOPMENT TIME  16.9(MONTH) COMPONENT QUALIFICATION TIME   2.9(MONTH)
              SUBSYSTEM DEVELOPMENT TIME   4.7(MONTH) SUBSYSTEM QUALIFICATION TIME   7.2(MONTH)
              SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME   4.7(MONTH)
MISSION EQUIPMENT
            WEIGHT        181.00(LB), VOLUME        257.41(FT**3), POWER REQUIREMENT       300.0(WATT)
            DDT+E COST         32300000.0         AVERAGE UNIT COST       3340000.0
            RELIABILITY             .7000
            SCHEDULE
              COMPONENT DEVELOPMENT TIME   0.0(MONTH) COMPONENT QUALIFICATION TIME   0.0(MONTH)
              SUBSYSTEM DEVELOPMENT TIME   0.0(MONTH) SUBSYSTEM QUALIFICATION TIME   0.0(MONTH)
              SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME   0.0(MONTH)
```

Figure 8-2. Sample Test Case Results (Continued)

```
THERMAL CONTROL
  RADIATOR AREA            4.2 (FT**2),  BATTERY RADIATOR AREA              1.1 (FT**2)
                                         TOTAL RADIATOR AREA                5.3 (FT**2)
  HEATER POWER           268.7(BTU/HR),  BATTERY HEATER POWER             110.0(BTU/HR)
                                         TOTAL HEATER POWER               378.7(BTU/HR)
  HEAT PIPE            14768.4(WATT-IN), VARIABLE CONDUCTANCE H.P.       1560.4(WATT-IN)
  THERMAL CONTROL WEIGHT         14.7(LBS)
            DES. ENG. COST     350490.8          TEST + EVAL. COST       266219.0
            UNIT PROD.COST      40950.1          UNIT ENG.    COST        78592.1
            IERR      1100010111
STRUCTURES
  SKIN THICKNESS          .007 (IN)
  STRINGER NO.,THICKNESS,HT.         17.     ,           .013 (IN),               .370 (IN)
  FRAME    NO.,THICKNESS,HT.          5.     ,           .075 (IN),               .825 (IN)
  ENDCOVER THICKNESS- FORWARD       .221 (IN), CENTER   0.000 (IN), AFT           .221 (IN)
  EQUIPMENT BAY STRUCTURE WT.       175.2 (LBS)
  SOLAR ARRAY BOOM AND DRIVE WT.      0.0 (LBS)
  ADAPTER WEIGHT                     14.2 (LBS)
            DES. ENG. COST    1100802.7          TEST + EVAL. COST       422807.4
            UNIT PROD.COST     197919.6          UNIT ENG.    COST       246838.0
```

Figure 8-2. Sample Test Case Results (Continued)

DSCS-II

* * * * ASSEMBLY DESCRIPTIONS - - DESIGN NUMBER 1 * * * *

STABILIZATION AND CONTROL

IDENT	TYPE	NO.	UNIT WEIGHT	UNIT VOLUME	UNIT POWER	D.E. COST	T.E. COST	VEHICLE PROD. COST	VEHICLE ENG COST
151	DESPIN MECH+ELECT.	2	30.2	.9	8.2	1468500.0	860200.0	277028.5	544694.8
252	VALVE DRIVE ASSY.	1	4.2	.4	.1	164000.0	15000.0	19950.6	36774.5
352	SUN SENSOR W/ELECT	2	2.2	.2	1.0	290000.0	173000.0	17100.5	107566.6
451	NUTATION DAMPNER	1	4.0	.8	0.0	155000.0	25000.0	8550.2	34756.3
551	GIMBAL ELECT. ASSY	1	6.3	.3	3.5	0.0	0.0	0.0	0.0
651	CONTROL TIMING ASS	2	7.4	.4	3.5	651000.0	440000.0	191525.9	241468.4
751	BIAXIAL DRIVE ASSY	2	14.2	.3	2.8	0.0	0.0	0.0	0.0
801	NONSCAN EARTH SENS	2	7.7	.0	.6	66000.0	105000.0	56431.7	24480.7
1401	S/C PWR CONVERTER	2	5.1	.2	10.6	0.0	0.0	0.0	0.0

AUXILIARY PROPULSION

IDENT	TYPE	NO.	UNIT WEIGHT	UNIT VOLUME	UNIT POWER	D.E. COST	T.E. COST	VEHICLE PROD. COST	VEHICLE ENG COST
807	THRUSTER TRW MRE-3	6	.6	.1	1.0	112362.5	171700.0	33427.1	82303.9
807	THRUSTER TRW MRE-3	2	.6	.1	1.0	101000.0	101000.0	13167.4	37462.8
902	MONO ISO 22700	5	1.3	.1	0.0	0.0	0.0	0.0	0.0
1001	MONO FIL3181406100	9	.5	.1	-0.0	0.0	0.0	0.0	0.0
459	PRES REG 51310	2	4.1	.4	-0.0	511750.0	212500.0	80372.5	189817.9
201	ISO VALVE 272-454	1	.5	.1	-0.0	0.0	0.0	0.0	0.0
1102	MONO SPHER 80156-1	8	2.9	.2	-0.0	0.0	0.0	0.0	0.0
503	PNEUM TANK	1	27.8	.8	-0.0	0.0	0.0	0.0	0.0
701	RELIEF VALVE	2	.2	.0	-0.0	0.0	0.0	0.0	0.0
1201	MONO FILL	2	.2	.0	-0.0	0.0	0.0	0.0	0.0
601	FILL+VENT 34650-1	2	.2	.0	-0.0	0.0	0.0	0.0	0.0

DATA PROCESSING AND INSTRUMENTATION

IDENT	TYPE	NO.	UNIT WEIGHT	UNIT VOLUME	UNIT POWER	D.E. COST	T.E. COST	VEHICLE PROD. COST	VEHICLE ENG COST
201	SPEC.PURP.PRO.DTU.	2	10.4	1.0	3.0	210000.0	97000.0	59851.8	77893.0

COMMUNICATIONS

IDENT	TYPE	NO.	UNIT WEIGHT	UNIT VOLUME	UNIT POWER	D.E. COST	T.E. COST	VEHICLE PROD. COST	VEHICLE ENG COST
101	BASEBAND ASM. UNIT	2	.9	.0	.5	29000.0	9000.0	27360.8	10756.7
201	ANTENNA	1	5.6	5.6	-0.0	180000.0	153000.0	30400.9	40362.2
301	TRANSMITTER	2	1.9	.2	10.0	50000.0	50000.0	34201.0	18546.0
401	RECEIVER	2	4.0	.4	3.0	76000.0	171000.0	59851.8	28189.9
502	COMID SIG COND.IER	2	1.4	.1	1.0	36000.0	27000.0	42751.3	13353.1
601	CIPLEXER	1	.8	.0	1.0	10000.0	6000.0	6650.2	2242.3
701	CONVERTER (TRANS.)	2	1.8	.2	13.5	0.0	0.0	0.0	0.0
702	CONVERTER RECEIVER	2	1.8	.2	7.6	0.0	0.0	0.0	0.0

Figure 8-2. Sample Test Case Results (Continued)

ELECTRICAL POWER

IDENT	TYPE	NO.	UNIT WEIGHT	UNIT VOLUME	UNIT POWER	D.E. COST	T.E. COST	VEHICLE PROD. COST	VEHICLE ENG COST
101	SHUNT REGULATOR	10	4.2	1.0	-0.0	0.0	0.0	0.0	0.0
211	BATTERY CELL	2	61.6	.2	-0.0	421000.0	143000.0	89264.7	156157.0
359	BATTERY CHARGER	2	3.8	.1	-0.0	0.0	0.0	0.0	0.0
1201	POWER CONTROL UNIT	1	10.5	.2	-0.0	0.0	0.0	0.0	0.0

EQUIPMENTS USING COST ESTIMATING RELATIONSHIPS

NAME	WEIGHT	D.E. COST	T.E. COST	VEHICLE PROD. COST	VEHICLE ENG. COST
SOLAR ARRAY	127.5	703177.7	385011.2	409768.6	157676.7
HARNESS	97.6	518594.2	437565.9	177366.3	116286.7
THERMAL CONTROL	14.7	350490.8	266219.0	40950.1	78592.1
POWER CONVERTERS	17.2	482774.9	283601.1	115211.0	108254.8
PROPULSION FEED SYS.		279784.9	159789.6	161338.2	62737.4
STRUCTURE	175.2	1100802.7	422807.4	197919.6	246838.0
POWER CONTROL UNITS	60.0	568321.7	300076.2	73375.7	127437.3

Figure 8-2. Sample Test Case Results (Continued)

9. SOURCE CODE LISTING

The following is a listing of the Systems Cost/Performance Computer Program.

```
C        THIS IS THE MAIN DRIVER                                            NASA      2
C        IT SEQUENCES ALL SEGMENTS OF CODING,HANDLES I/O,SETS               NASA      3
C        CONFIGURATIONS                                                     NASA      4
C     ******************************************************************* 101574    1
      PROGRAM NASACP (INPUT,OUTPUT,TAPE1,TAPE5=INPUT,TAPE6=OUTPUT)          101574    2
      COMMON /USER1/      ALPHA,       AX,       AY,       AZ,     DPHI,    022575    1
     1                       EA,     EANT,      EP1,        K,     MANV,    022575    2
     2                    OMEGR,   PDOTAV,   PDOTRX,   PDOTRY,   PDOTRZ,    022575    3
     3                   PDOTST,    PDOTX,    PDOTY,    PDOTZ,    PDOT0,    022575    4
     4                   PHIFOV,    PHIRX,    PHIRY,    PHIRZ,   TACCEL,    022575    5
     5                   THETMX,    THOLD,       TL,    TPMIN,   TSMALL,    022575    6
     6                       XN,      XNN,     XNNN,      XNU,       YN,    022575    7
     7                       ZN                                             022575    8
C                                                                           022575    9
      COMMON /USER3/ARRAYN(11,3), BTRMX,    NMSEQ,    OPSMS,    SCSFL,      022575   10
     1                    TPRFL                                             022575   11
C                                                                           022575   12
      COMMON /USER4/BWIDTH(2),  FREQ(2),    FREQR,   IOPTCM,     LINK,      032475    1
     1                    NADIR,      NET                                   022575   14
C                                                                           022575   15
      COMMON /USER6/ CGEEX(9), EELOC(9), EEQVL(9),   EM1YCG,   EM1ZCG,      022575   16
     1              EQPF,    EM2YCG,   EM2ZCG,   ISBOFG,   NUMEEQ,   XCGSA3 022575   17
C                                                                           022575   18
      COMMON /USER8/SKDME(7,3)                                              022575   19
C                                                                           022575   20
      COMMON /USER9/         CA,       CE                                   022575   21
C                                                                           022575   22
      COMMON /USERR/       ISPT,     ISUB,    KEOPT,   RFIXED,    SLBMX     022575   23
C                                                                           022575   24
      COMMON /USERC/     FEEPCT,   IMETYP,      NFV,      NQV,       PI     022575   25
C                                                                           022575   26
      COMMON /USERP/     IPRINT,   ITITLE                                   022575   27
C                                                                           022575   28
      COMMON /USERI/     APOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME,    022575   29
     1                   EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT,    022575   30
     2                   EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY,    022575   31
     3          IDEBUG,  ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE,    022575   32
     4           MICRO,   RELME,  SPEC(6),    SPEC1,        T,   XCGSA1,    022575   33
     5                     XMER,     XMEU                                   022575   34
C                                                                           022575   35
      COMMON /BTWN/       ACSSN,    ACSWP,      ALT,     AREA,   BATCAP,    022575   36
     1               BITRAT(2),    CLIFE,   CONVWT,        D,       DT,    022575   37
     2                       DX,       DY,       DZ,    EQBLG,   EQBSID,    022575   38
     3                       FC,       FF,   HARNWT,      HPT,   HTPIPE,    022575   39
     4                     HTPT,   HTRPRB,   HTRPWR,               IBTLOC,    022575   40
     5                    LPBDD,       NC,    OMEGS,   PASSTR,       PJ,    022575   41
     6                       PL,    PLMIN,   POCNWT,     RADA,    RADAB,    022575   42
     7                      RAT,       RJ,   SABOLG,    SATLG,   SATTWT,    022575   43
     8                    SATWT,   SATXCG,   SATYCG,   SATZCG,   SA1XL,     022575   44
     9                    SA1YL,    SA1ZL,     SIDE,    SYSLB,   THCMWT,    022575   45
     A               THRUST(2),       TI,    TNKWT,    TPRIM,       VB,    022575   46
     B                     VCHP,      VOL,     WATE,       WB,      WBT,    022575   47
     C                       WT,       XJ,   XNZERO,       YJ,       ZJ     022575   48
C                                                                           022575   49
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      COMMON /DBCOM/CATAB(55,100),IDE(30)                                022575    50
C                                                                        022575    51
      COMMON /CHOSE/     COST(5,60),      DPIA(11,60),     ICHOSE(60),   022575    52
     1                   NCHOSE(60),      REL ( 6,60),     SKD(7,60),    022575    53
     2                   THM(4,60)                                       022575    54
C                                                                        022575    55
      COMMON/PRTCOM/    ACCRCY,        AM,         AN,        BF,        BS,   022575    56
     1            CDPI(7,2),    CISTAR,       CTOT,      DOTE,        DE,   022575    57
     2                DRIWT,    EQBSTR,     FEEINV,    FEEOPS,      FEER,   022575    58
     3                  GSE,      IREL,     ITRUNC,    MMDOLD,NAME(3,60),    022575    59
     4                  OPS,    PAYINV,     PAYQUL,      PAYR,        PE,   022575    60
     5                  PMP,       PMR,   POWER(6),        PU,   PWR(60),   022575    61
     6                  QCP,       QCF,   ROLD(60),    SABMWT,    SATADP,   022575    62
     7               SATINV,      SATR,       SEIP,      SEIR, SKTAU(6),   022575    63
     8             SSREL(6),   SUBE(7),    SUBT(7),  SUBUE(7),  SUBUP(7),   022575    64
     9                   TA,  TAU(6,6),         TB,        TC,        TE,   022575    65
     A                   TF,     TOOLR,      TOOLU,    TOTOPS,     TRUNC,   022575    66
     B                   TS,       TTT,VOLUME(6),  VQL(60),WEIGHT(6),   022575    67
     C               XLTOT,      XMEH,     XMEINV,      XMEL,     XMEVL,   022575    68
     D                 XMEW,     XMEWT,      XVEST                         022575    69
      DIMENSION NCONF(6),NEQUIP(5),IERR(7),IPIC1(3),IPIC2(9),IPIC3(2),   NASA      37
     * IPIC4(9),IPIC5(5),ICHOS1(9),ICHOS2(14),ICHOS3(2),ICHOS4(11),      NASA      38
     *ICHOS5(5),NCHOS1(9),NCHOS2(14),NCHOS3(2),NCHOS4(11),NCHOS5(5)      NASA      39
      DIMENSION ITITLE(13)                                               111974     4
C                                                                        121374     1
C ************************************************************************ 121374     2
C **        THE NAMELIST INPUTS ARE BROKEN INTO THREE CATEGORIES. THAT   ** 121374     3
C **    IS CATEGORIES OF REQUIRED, DESIRED, AND OPTIONAL PARAMETERS.     ** 121374     4
C **    THE FOLLOWING IS A LIST OF THE INPUTS TO THE MODEL - -           ** 121374     5
C **                                                                     ** 121374     6
C **        NAME      REP.VALUE UNITS      DESCRIPTION                   ** 121374     7
C **    REQUIRED INPUT DATA                                              ** 121374     8
C **        APOGEE    500.        NMI      ORBIT APOGEE                  ** 121374     9
C **        EPME      300.        WATTS    MISSION EQUIP POWER REQ.      ** 121374    10
C **        EQM1WT    435.        LB       MISS.EQ.WT.-0.IF NO M.E. 1    ** 121374    11
C **        EQM2WT    435.        LB       MISS.EQ.WT.-0.IF NO M.E. 2    ** 121374    12
C **        IPRINT    1           ---      1=SYS,2=S/S,3=ASSEMBLY        ** 121374    13
C **        MICRO     0           ---      MICRO (S/S) FLAG              ** 121374    14
C **        NFV       4           ---      NO. FLITE VEHICLES            ** 121374    15
C **        NQV       1           ---      NO. QUAL. VEHICLES            ** 121374    16
C **        PERIGE    500.        NMI      ORBIT PERIGEE                 ** 121374    17
C **        SPEC6     0.6         ---      SYS. REL. AT EOL              ** 121374    18
C **        SPEC1     18.         MO       SYS. MMD REQ.                 ** 121374    19
C **        T         24.         MO       MISSION LIFETIME              ** 121374    20
C **                                                                     ** 121374    21
C **    DESIRABLE INPUT DATA                                             ** 121374    22
C **        ARRAYN                         MISSION DATA FOR UP TO 3 EQ.  ** 121374    23
C **        CGEEX     2.          ---      LOC.OF EXT.EQ.(FT,CENT,AFT)   ** 121374    24
C **        EELOC     3.          ---      LOC.OF EXT.EQ.(RT,LFT,TOP,BOT)** 121374    25
C **        EEQVL     0.          FT**3    EXT. EQ. VOLUMES              ** 121374    26
C **        EEQWT     0.          LB       EXT. EQ. WEIGHTS              ** 121374    27
C **        EM1YCG    0.          IN       M.E. 1 Y-CG                   ** 121374    28
C **        EM1ZCG    0.          IN       M.E. 1 Z-CG                   ** 121374    29
C **        EM2YCG    0.          IN       M.E. 2 Y-CG                   ** 121374    30
C **        EM2ZCG    0.          IN       M.E. 2 Z-CG                   ** 121374    31
C **        EQM1XL    40.         IN       M.E. 1 LENGTH                 ** 121374    32
C **        EQM1YL    40.         IN       M.E. 1 WIDTH                  ** 121374    33
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C  **        EQM1ZL     40.       IN          M.E. 1 HEIGHT                    ** 121374      34
C  **        EQM2XL     40.       IN          M.E. 2 LENGTH                    ** 121374      35
C  **        EQM2YL     40.       IN          M.E. 2 WIDTH                     ** 121374      36
C  **        EQM2ZL     40.       IN          M.E. 2 HEIGHT                    ** 121374      37
C  **        IAGNCY     1         ---         AGENCY TYPE 1=USAF, 2=NASA       ** 121374      38
C  **        IMETYP     2         ---         M.E.TYPE,1=COM,2=EO,3=LUN,4=PL** 121374       39
C  **        ISATOR     1         ---         ORIENT. 1=EO,2=SO,3=IO           ** 121374      40
C  **        MB12SH     1         ---         M.E.BAY SHAPE,1=CYL,2=BOX        ** 121374      41
C  **        NMSEQ      1         ---         NO. M.E. TT+C DATA ARRAYS        ** 121374      42
C  **        NUMEEQ     0         ---         NO. EXT. EQ.                     ** 121374      43
C  **        OPSMS      0.        OPS/SEC     NO. MISS. OPS                    ** 121374      44
C  **        PHIRX      0.75      DEG         REQ. ROLL  ACCURACY              ** 121374      45
C  **        PHIRY      0.75      DEG         REQ. PITCH ACCURACY              ** 121374      46
C  **        PHIRZ      0.75      DEG         REQ. YAW   ACCURACY              ** 121374      47
C  **        PI         1.0       ---         PRICE INDEX FACTOR               ** 121374      48
C  **        RELME      1.0       ---         M.E. REL. AT EOL                 ** 121374      49
C  **        SKDME      0.        ---         M.E. SKED DATA                   ** 121374      50
C  **        XMER       0.        ---         M.E. DDT+E COST                  ** 121374      51
C  **        XMEU       0.        ---         M.E. AVG UNIT COST               ** 121374      52
C  **                                                                          ** 121374      53
C  **   OPTIONAL INPUT DATA                                                    ** 121374      54
C  **        ALPHA      12.0      DEG         THRSTR OFFSET IN ROLL-YAW        ** 121374      55
C  **        AX         .05       DEG         MISALIGNMENT ERRORS IN           ** 121374      56
C  **        AY         .05       DEG         MOUNTING INERTIA UNITS           ** 121374      57
C  **        AZ         .05       DEG         (3-AXIS MASS EXP. ONLY)          ** 121374      58
C  **        BTRMX      1.024 E+06BIT/SEC     MAXIMUM BIT RATE                 ** 121374      59
C  **        BWIDTH     2*(-1.E10)HZ          BANDWIDTH FOR XMTR(S)            ** 121374      60
C  **        CA         10.       G           AXIAL LAUNCH ACCELRATION         ** 121374      61
C  **        CE         5.        G           LATERAL LAUNCH ACCELERATION      ** 121374      62
C  **        COMRAT     1000.     BAUD        RECEIVER COMMAND RATE            ** 121374      63
C  **        DIAMAX     120.      IN          MAXIMUM SATELLITE DIAMETER       ** 121374      64
C  **        DPHI       .25       DEG         MAIN ENG.ALIGN TO THRST AXIS     ** 121374      65
C  **        EA         .10       DEG         ANTENNA MISALIGNMENT(PM ONLY)    ** 121374      66
C  **        EANT       .1        RAD         ANTENNA ELEVATION   (PM ONLY)    ** 121374      67
C  **        EP1        .0001     DEG/SEC     MAX PGM PITCHOVER RATE(3-AXIS)** 121374       68
C  **        EQPF       2.        ---         VOLUME SIZING FACTOR             ** 121374      69
C  **        FE         4.1       DEG         TRANSLATIONAL THRST(NON-ZERO)    ** 121374      70
C  **        FEEPCT     .07       ---         CONTRACTOR FEE PERCENTAGE        ** 121374      71
C  **        FREQ       2*(2250.) MHZ         FREQ OF DOWNLINK XMTR(S)         ** 121374      72
C  **        FREQR      1800.     MHZ         RECEIVER FREQUENCY               ** 121374      73
C  **        IDEBUG     0         ---         0=DEBUG OFF, 1=DEBUG ON          ** 022675       1
C  **        IEND1      5         ---         LAST ALLOWABLE FOR SANDC         ** 121374      74
C  **        IEND2      3         ---         LAST ALLOWABLE FOR AP            ** 121374      75
C  **        IEND3      2         ---         LAST ALLOWABLE FOR DPI           ** 121374      76
C  **        IEND4      5         ---         LAST ALLOWABLE FOR COMM          ** 121374      77
C  **        IEND5      6         ---         LAST ALLOWABLE FOR EP            ** 121374      78
C  **        IEND6      3         ---         LAST ALLOWABLE FOR VESIZE        ** 121374      79
C  **        IENDR      1         ---         LAST ALLOWABLE FOR RELY          ** 121374      80
C  **        IOPTCM     0         ---         RANGING REQUIREMENT  0=NO,1=YES** 121374        81
C  **        ISBOFG     0         ---         SA BOOM DRIV REQ     0=NO,1=YES** 121374        82
C  **        ISPT       0         ---         SINGLE PT FAIL REQ   0=NO        ** 121374      83
C  **        ISTRT1     1         ---         FIRST ALLOWABLE FOR SANDC        ** 121374      84
C  **        ISTRT2     1         ---         FIRST ALLOWABLE FOR AP           ** 121374      85
C  **        ISTRT3     1         ---         FIRST ALLOWABLE FOR DPI          ** 121374      86
C  **        ISTRT4     1         ---         FIRST ALLOWABLE FOR COMM         ** 121374      87
C  **        ISTRT5     1         ---         FIRST ALLOWABLE FOR EP           ** 121374      88
C  **        ISTRT6     1         ---         FIRST ALLOWABLE FOR VESIZE       ** 121374      89
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C **       ISTRTR     0          ---        FIRST ALLOWABLE FOR RELY          ** 121374     90
C **       ISUB       0          ---        S/S REL FLAG 1=AT LEAST 1 S/S     ** 121374     91
C **       K          1          ---        AXIS RELATIVITY (DUAL-SPIN)       ** 121374     92
C **       KEOPT      1          ---        EXPENSE OPT IND                   ** 121374     93
C **       LINK       1          ---        COMM LINK(0=USB,1=SGLS)           ** 121374     94
C **       MANV       1          ---        VEH SKEWING FLAG.                 ** 121374     95
C **       NADIR      1          ---        NADIR COVERAGE FLAG               ** 121374     96
C **       NET        1          ---        0=AFSCF NET, 0=NASA NET           ** 121374     97
C **       OMEGR      60.        RPM        SPIN RATE OF ROTOR                ** 121374     98
C **       OPTEMP     15.        DEG C      BATT. TEMP.                       ** 121374    100
C **       ORBINC     28.5       DEG        ORBITAL INCLINATION               ** 121374    101
C **       PDOTAV     .01        DEG/SEC    AVG BODY RATE LO ORBIT CMG ONL    ** 121374    102
C **       PDOTRX     .012       DEG/SEC    REQ SYS RATE ACC. X               ** 121374    103
C **       PDOTRY     .012       DEG/SEC    REQ SYS RATE ACC. Y               ** 121374    104
C **       PDOTRZ     .012       DEG/SEC    REQ SYS RATE ACC. Z               ** 121374    105
C **       PDOTST     .0667      DEG/SEC    MAX RATE STAR RATE INFO(CMG)      ** 121374    106
C **       PDOTX      1.         DEG/SEC    MAX MANV. RATE       X            ** 121374    107
C **       PDOTY      1.         DEG/SEC    MAX MANV. RATE       Y            ** 121374    108
C **       PDOTZ      1.         DEG/SEC    MAX MANV. RATE       Z            ** 121374    109
C **       PDOTO      1.         DEG/SEC    MAX INIT. RATE                    ** 121374    110
C **       PHIFOV     40.0       DEG.       MAX RNG ATT FROM TRK STAR(CMG)    ** 121374    111
C **       RFIXED     1.         ---        INITIAL SYSTEM RELIABILITY        ** 121374    112
C **       SCSFL      0.         ---        SPEC. CMD SYNC FLG 0=NO 1=YES     ** 121374    113
C **       SLBMX      50000.     LB         MAXIMUM SYSTEM WEIGHT             ** 121374    114
C **       SPEC(1)    .9         ---        SANDC  S/S REL. REQ.              ** 121374    115
C **       SPEC(2)    .9         ---        AP     S/S REL. REQ.              ** 121374    116
C **       SPEC(3)    .9         ---        DPI    S/S REL. REQ.              ** 121374    117
C **       SPEC(4)    .9         ---        COMM   S/S REL. REQ.              ** 121374    118
C **       SPEC(5)    .9         ---        EP     S/S REL. REQ.              ** 121374    119
C **       TACCEL     20.        SEC.       ACCEL TIME FOR MANV. (CMG)        ** 121374    121
C **       THETMX     180.       DEG.       MAX MANV ANGLE(CMG ONLY)          ** 010775      2
C **       THOLD      100000.    MIN        TIME VEH.INERT HOLD   (CMG)       ** 121374    125
C **       TL         1.0        DAY        TIME BTWN UNLOAD WHL MMNT(CMG)    ** 121374    126
C **       TPMIN      1.0        SEC.       MIN P/L SCAN PERIOD               ** 010775      3
C **       TPRFL      0.         ---        TLMTRY PROG FLG 0=SEPARATE        ** 121374    127
C **       TSMALL     100.       SEC        MAIN ENG BURN TIME                ** 121374    128
C **       XCGSA1     1.         ---        LOC SLR PDDLES 1=F,2=C,3=A        ** 121374    129
C **       XCGSA3     1.         ---        LOC BDY MTD SA 1=F,2=C,3=A        ** 121374    130
C **       XN         1.         ---        NO. MANV. ABOUT ROLL AXIS         ** 121374    131
C **       XNN        21.        DAYS       TIME BTWN SA CORR. (DUAL SPIN)    ** 121374    132
C **       XNNN       4.0        ---        NO SING GIMB GYROS (CMG)          ** 121374    133
C **       XNU        3.0        ---        CONTROL SYSTEM EFFICIENCY         ** 121374    134
C **       YN         1.         ---        NO. MANV ABOUT PITCH AXIS         ** 121374    135
C **       ZN         1.         ---        NO. MANV ABOUT YAW   AXIS         ** 121374    136
C **                                                                          ** 121374    137
C ****************************************************************************** 121374    138
C                                                                                121374    139
C                                                                                121374    140
C                                                                                121374    141
      NAMELIST /REQUIR/       APOGEE,    EPME,     EQM1WT,    EQM2WT,            121374    142
     *                                   IPRINT,   MICRO,     NFV,               022675      2
     *                        NOV,       PERIGE,   SPEC1,     SPEC6,             012775      4
     *                        T                                                  012775      5
C                                                                                121374    145
C                                                                                121374    146
C                                                                                121374    147
      NAMELIST /DESIRE/       ARRAYN,    CGEEX,    EELOC,     EEGVL,             121374    148
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     *                          EEQWT,    EM1YCG,   EM1ZCG,   EM2YCG,     121374   149
     *                          EM2ZCG,   EQM1XL,   EQM1YL,   EQM1ZL,     121374   150
     *                          EQM2XL,   EQM2YL,   EQM2ZL,   IAGNCY,     121374   151
     *                          IMETYP,   ISATOR,   MB12SH,   NMSEQ,      121374   152
     *                          NUMEEQ,   OPSMS,    PHIRX,    PHIRY,      121374   153
     *                          PHIRZ,    PI,       RELME,    SKOME,      121374   154
     *                          XMER,     XMEU                            121374   155
C                                                                         121374   156
C                                                                         121374   157
C                                                                         121374   158
      NAMELIST /OPTION/         ALPHA,    AX,       AY,       AZ,         121374   159
     1                          BTRMX,    BWIDTH,   CA,       CE,         121374   160
     2                          COMRAT,   DIAMAX,   DPHI,     EA,         121374   161
     3                          EANT,     EP1,      EQPF,     FE,         121374   162
     4                          FEEPCT,   FREQ,     FREQR,    IEND1,      121374   163
     5                IDEBUG,   IEND2,    IEND3,    IEND4,    IEND5,      022675     3
     6                          IEND6,    IENDR,    IOPTCM,   ISBOFG,     121374   165
     7                          ISPT,     ISTRT1,   ISTRT2,   ISTRT3,     121374   166
     8                          ISTRT4,   ISTRT5,   ISTRT6,   ISTRTR,     121374   167
     9                          ISUB,     K,        KEOPT,    LINK,       121374   168
     A                          MANV,     NADIR,    NET,      OMEGR,      121374   169
     B                                    OPTEMP,   ORBINC,   PDOTAV,     010775     4
     C                          PDOTRX,   PDOTRY,   PDOTRZ,   PDOTST,     121374   171
     D                          PDOTX,    PDOTY,    PDOTZ,    PDOTO,      121374   172
     E                          PHIFOV,   RFIXED,   SCSFL,    SLBMX,      121374   173
     F                          SPEC,               TACCEL,               011275     2
     G                                              THETMX,   THOLD,      011275     3
     H                          TL,       TPMIN,    TPRFL,    TSMALL,     010775     6
     I                          XCGSA1,   XCGSA3,   XN,       XNN,        010775     7
     J                          XNNN,     XNU,      YN,       ZN          010775     8
C                                                                         121374   179
C                                                                         121374   180
      DATA NEQUIP,NACCEP/6*0/                                             NASA      60
      DATA ISTRT1,IEND1,ISTRT2,IEND2,ISTRT3,IEND3,ISTRT4,IEND4,ISTRT5,    NASA      61
     *IEND5,ISTRT6,IEND6,ISTRTR,IENDR/1,5,1,3,1,2,1,5,1,6,1,3,0,1/        NASA      62
      DATA ITEST1,ITEST2,ITEST3,ITEST4,ITEST5/9,14,2,11,5/                NASA      63
      READ 5,ITITLE                                                       111974     6
    5 FORMAT(13A6)                                                        111974     7
      IDEBUG = 0                                                          012775     6
      SPEC6 = SPEC(6)                                                     021975     1
      DO  6 I=1,5                                                         121374   183
    6 SPEC(I) = -1.                                                       121374   184
      READ  (5,REQUIR)                                                    121374   185
      READ  (5,DESIRE)                                                    121374   186
      READ  (5,OPTION)                                                    121374   187
      SPEC(6) = SPEC6                                                     121374   188
      TTHST=FE                                                            NASA      77
      ISEQ=ISATOR                                                         NASA      78
      IREL=ISTRTR                                                         NASA      79
      ISAT=ISATOR                                                         NASA      80
      CALL PRESET(IERRI)                                                  121674     1
      IF(IERRI.LT.0) GO TO 99                                             121674     2
      WRITE  (6,REQUIR)                                                   011275     4
      WRITE  (6,DESIRE)                                                   011275     5
      WRITE  (6,OPTION)                                                   011275     6
      PRINT 9500                                                          030375     1
 9500 FORMAT(1H1)                                                         030375     2
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    2 CO 1  I1=ISTRT1,IEND1                                          NASA      81
      DO 1  I2=ISTRT2,IEND2                                          NASA      82
      DO 1  I3=ISTRT3,IEND3                                          NASA      83
      CO 1  I4=ISTRT4,IEND4                                          NASA      84
      DO 1  I5=ISTRT5,IEND5                                          NASA      85
      DO 1  I6=ISTRT6,IEND6                                          NASA      86
      CALL  CPTIME(TIMEIN)                                           SPEC       1
      NCONF(1)=I1                                                    NASA      87
      NCONF(2)=I2                                                    NASA      88
      NCONF(3)=I3                                                    NASA      89
      NCONF(6)=I6                                                    NASA      90
      NCONF(5)=I5                                                    NASA      91
      NCONF(4)=I4                                                    NASA      92
      CALL  FILTER(NCONF,ICODE)                                      NASA      93
      IF  (ICCDE .LT. 0)  GO TO 14                                   022075     1
      IPIC1(1)=0                                                     NASA      95
      IPIC1(2)=0                                                     NASA      96
      IPIC1(3)=0                                                     NASA      97
      DO 23  I=1,9                                                   NASA      98
   23 IPIC2(I)=0                                                     NASA      99
      IPIC3(1)=0                                                     NASA     100
      IPIC3(2)=0                                                     NASA     101
      DO 24  I=1,9                                                   NASA     102
   24 IPIC4(I)=0                                                     NASA     103
      DO 20  I=1,5                                                   NASA     104
   20 IPIC5(I)=0                                                     NASA     105
   11 CALL  INITIL(NCONF,IERRI)                                      NASA     106
      IF  (IERRI .EQ. 1)  GC TO 14                                   022075     2
      FRINT  9000,NCONF                                              012375     1
      FRINT  9000,ICHCSE                                             012375     2
      FRINT  9000,NCHOSE                                             012375     3
      DO 10  ITR=1,2                                                 NASA     108
      REWIND 1                                                       NASA     109
      IENDDB=1                                                       NASA     110
      ITER=ITR-1                                                     NASA     111
      CALL  READDB(IENDDB)                                           NASA     112
      IF  (ITER .NE. C .OR. MICRC .EQ. 1)  GO TO 91                  NASA     113
      IPIC1(1)=0                                                     NASA     114
      IPIC1(2)=0                                                     NASA     115
      IPIC1(3)=0                                                     NASA     116
   91 CALL  SANDC(IPIC1,IERR(1),ITER,NCCNF,ICHOS1,NCHOS1)            NASA     117
      WRITE  (6,1999)  TI                                            NASA     118
 1999 FORMAT  (3H TI,E15.4)                                          NASA     119
      NEQUIP(1)=0                                                    NASA     120
      DO 101  I=1,ITEST1                                             NASA     121
      IF  (ICHOS1(I).LT. 0)  GO TO 14                                022075     3
      IF  (ICHOS1(I)  .GT. 0)  NEQUIP(1)=NEQUIP(1)+1                 NASA     123
  101 CONTINUE                                                       NASA     124
      WEIGHT(1)=WT                                                   111874     4
      VOLUME(1)=VOL                                                  111874     5
      POWER(1)=PL                                                    111874     6
      WRITE  (6,1000)  WT,VOL                                        NASA     125
 1000 FORMAT(1X,2E15.4)                                              NASA     126
      NOWAT=1                                                        NASA     127
      CALL  SAVE(ICHOS1,NCHOS1,NOWAT,ITEST1,IENDDB)                  NASA     128
      CALL  READDB(IENDDB)                                           NASA     129
      IF  (ITER .NE. C .OR. MICRO .EQ. 2)  GO TO 92                  NASA     130
```

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      DO 28 I=1,9                                                      NASA      131
   28 IPIC2(I)=0                                                       012375      4
   92 CALL AUXPRO (IPIC2,IERR(2),ITER,NCONF,ICHOS2,NCHOS2)             022875      1
      NEQUIP(2)=0                                                      NASA      134
      DO 102 I=1,ITEST2                                                NASA      135
      IF (ICHOS2(I) .LT. 0 .AND. MICRO .LT. 2) GO TO 13                NASA      136
      IF (ICHOS2(I) .LT. 0 .AND. MICRO .EQ. 2) GO TO 14                022075      5
      IF (ICHOS2(I) .GT. 0) NEQUIP(2)=NEQUIP(2)+1                      NASA      138
  102 CONTINUE                                                         NASA      139
      WEIGHT(2)=WT-WEIGHT(1)                                           111874      7
      VOLUME(2)=VOL-VOLUME(1)                                          111874      8
      POWER(2)=PL-POWER(1)                                             111874      9
      TEMPWT=WT                                                        111874     10
      TEMPVL=VOL                                                       111874     11
      TEMPPL=PL                                                        111874     12
      WRITE (6,1000) WT,VOL                                            NASA      140
      CALL SAVE(ICHOS2,NCHOS2,NOWAT,ITEST2,IENDDB)                     NASA      141
      CALL READDB(IENDDB)                                              NASA      142
      IF (ITER .NE. 0 .OR. MICRO .EQ. 3) GO TO 93                      NASA      143
      IPIC3(1)=0                                                       NASA      144
      IPIC3(2)=0                                                       NASA      145
   93 CALL DPI(IPIC3,IERR(3),ITER,NCONF,ICHOS3,NCHOS3,NOWAT)           NASA      146
      NEQUIP(3)=0                                                      NASA      147
      DO 103 I=1,ITEST3                                                NASA      148
      IF (ICHOS3(I) .LT. 0 .AND. MICRO .LT. 3) GO TO 13                NASA      149
      IF (ICHOS3(I) .LT. 0 .AND. MICRO .EQ. 3) GO TO 14                022075      6
      IF (ICHOS3(I) .GT. 0) NEQUIP(3)=NEQUIP(3)+1                      NASA      151
  103 CONTINUE                                                         NASA      152
      WEIGHT(3)=WT-TEMPWT                                              111874     13
      VOLUME(3)=VOL-TEMPVL                                             111874     14
      POWER(3) =PL-TEMPPL                                              111874     15
      TEMPWT=WT                                                        111874     16
      TEMPVL=VOL                                                       111874     17
      TEMPPL=PL                                                        111874     18
      WRITE (6,1000) WT,VOL                                            NASA      153
      CALL SAVE(ICHOS3,NCHOS3,NOWAT,ITEST3,IENDDB)                     NASA      154
      CALL READDB(IENDDB)                                              NASA      155
      IF (ITER.NE.0 .OR. MICRO.EQ.4) GO TO 94                          NASA      156
      DO 29 I=1,9                                                      NASA      157
   29 IPIC4(I)=0                                                       NASA      158
   94 CALL COMM(IPIC4,IERR(4),ITER,NCONF,ICHOS4,NCHOS4)                NASA      159
      NEQUIP(4)=0                                                      NASA      160
      DO 104 I=1,ITEST4                                                NASA      161
      IF (ICHOS4(I) .LT. 0 .AND. MICRO .LT. 4) GO TO 13                NASA      162
      IF (ICHOS4(I) .LT. 0 .AND. MICRO .EQ. 4) GO TO 14                022075      7
      IF (ICHOS4(I) .GT. 0) NEQUIP(4)=NEQUIP(4)+1                      NASA      164
  104 CONTINUE                                                         NASA      165
      WEIGHT(4)=WT-TEMPWT                                              111874     19
      VOLUME(4)=VOL-TEMPVL                                             111874     20
      POWER(4)=PL-TEMPPL                                               111874     21
      TEMPWT=WT                                                        111874     22
      TEMPVL=VOL                                                       111874     23
      TEMPPL=PL                                                        111874     24
      WRITE (6,1000) WT,VOL                                            NASA      166
      CALL SAVE(ICHOS4,NCHOS4,NOWAT,ITEST4,IENDDB)                     NASA      167
      CALL READDB(IENDDB)                                              NASA      168
      IF (ITER .NE. 0 .OR. MICRO .EQ. 5) GO TO 95                      NASA      169
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      CO 21 I=1,5                                                       NASA     170
   21 IPIC5(I)=0                                                        NASA     171
   95 CALL EP(IPIC5,IERR(5),ITER,NCONF,ICHOS5,NCHOS5)                  NASA     172
      WRITE (6,8999) PL,PLMIN                                           NASA     173
 8999 FORMAT (9H PL,FLMIN ,2E15.4)                                      NASA     174
      NEQUIP(5)=0                                                       NASA     175
      CO 105 I=1,ITEST5                                                 NASA     176
      IF (ICHOS5(I) .LT. 0 .AND. MICRO .LT. 5) GO TO 13                 NASA     177
      IF (ICHOS5(I) .LT. 0 .ANC. MICRO .EQ. 5) GO TO 14                 022075     8
      IF (ICHOS5(I) .GT. 0) NEQUIP(5)=NEQUIP(5)+1                       NASA     179
      IF (ICHOS5(I)/100 .EQ. 2) IBTLOC=NOWAT-1+I                        NASA     180
  105 CONTINUE                                                          NASA     181
      WEIGHT(5)=WT-TEMPWT                                               111874    25
      VOLUME(5)=VOL-TEMPVL                                              111874    26
      POWER(5) = PL-TEMPPL-EPME                                         120474     1
      WRITE (6,1000) WT,VOL                                             NASA     182
      CALL SAVE(ICHOS5,NCHOS5,NOWAT,ITEST5,IENDDB)                      NASA     183
      CALL VESIZE(IERR(6),NCONF,ICHOS6)                                 NASA     184
      IF (ICHOS6 .LT. 0) GO TO 13                                       NASA     185
      IF (ITER .GT. 0) GO TO 10                                         NASA     186
      CALL RELY(IRTN,IREL,NEQUIP)                                       NASA     187
      FRINT 3000,IRTN                                                   NASA     188
 3000 FORMAT (5H IRTN,I10)                                              NASA     189
      IF (IRTN .LT. 0) GO TO 13                                         NASA     190
      IR1=1                                                             NASA     191
      IR2=NEQUIP(1)                                                     NASA     192
      CO 31 IR=1,IR2                                                    NASA     193
   31 NCHOS1(IR)=NCHOSE(IR)                                             NASA     194
      IR1=IR2+1                                                         NASA     195
      IR2=NEQUIP(2)                                                     NASA     196
      CO 32 IR=1,IR2                                                    NASA     197
      NCHOS2(IR)=NCHOSE(IR1)                                            NASA     198
   32 IR1=IR1+1                                                         NASA     199
      IR2=NEQUIP(3)                                                     NASA     200
      DO 33 IR=1,IR2                                                    NASA     201
      NCHOS3(IR)=NCHOSE(IR1)                                            NASA     202
   33 IR1=IR1+1                                                         NASA     203
      IR2=NEQUIP(4)                                                     NASA     204
      CO 34 IR=1,IR2                                                    NASA     205
      NCHOS4(IR)=NCHOSE(IR1)                                            NASA     206
   34 IR1=IR1+1                                                         NASA     207
      IR2=NEQUIP(5)                                                     NASA     208
      DO 35 IR=1,IR2                                                    NASA     209
      NCHOS5(IR)=NCHOSE(IR1)                                            NASA     210
   35 IR1=IR1+1                                                         NASA     211
   10 CONTINUE                                                          NASA     212
      CALL STRUCT(NCONF)                                                NASA     213
      CALL THRML(IERR(7),NCONF)                                         NASA     214
      NCHOSE(NOWAT)=0                                                   NASA     215
      CALL COSTS(NCONF,NEQUIP)                                          NASA     216
      CALL SKED(NEQUIP,NCONF)                                           NASA     217
      NACCEP=NACCEP+1                                                   NASA     218
      CALL PRNT(IERR,NEQUIP,NACCEP,NCONF)                               022875     2
   13 IF (MICRO .GT. 0) GO TO 11                                        NASA     220
      FRINT 9000,NCONF                                                  NASA     221
      FRINT 9000,(ICHOSE(I),I=1,NCWAT)                                  NASA     222
      FRINT 9000,(NCHOSE(I),I=1,NOWAT)                                  NASA     223
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       9000 FORMAT (10I10)                                                            NASA      224
            CALL CPTIME(TIMEOT)                                                       SPEC        2
            TIME=TIMEOT-TIMEIN                                                        SPEC        3
            FRINT 9999,TIME                                                           SPEC        4
       9999 FORMAT(1X,26HC.P. TIME FOR THIS CASE = ,F10.3,8H SECONDS)                 SPEC        5
         14 FRINT 9000,NCONF                                                          022075      9
            FRINT 9000,ICHOSE                                                         022075     10
            PRINT 9000,NCHOSE                                                         022075     11
          1 CONTINUE                                                                  NASA      225
            IF (IREL .EQ. IENDR) GO TO 99                                             NASA      226
            IREL=IENDR                                                                NASA      227
            GO TO 2                                                                   NASA      228
         99 STOP                                                                      NASA      229
            END                                                                       NASA      230
REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 266
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 427
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 431
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 435
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 439
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      SUBROUTINE PRESET(IERR)                                              121674     3
C                                                                          121674     4
C **  THIS SUBROUTINE CALCULATES WHAT USED TO BE EITHER CONSTANTS OR    ** 121674     5
C **  INPUT VALUES. IT NOW WILL CALCULATE THE VALUES OF THESE           ** 121674     6
C **  CONSTANTS FROM OTHER INPUT VALUES WHERE THEY ARE GIVEN ELSE IT    ** 121674     7
C **  WILL USE THE OLD CONSTANT VALUES.                                 ** 121674     8
C                                                                          121674     9
      COMMON /USER1/     ALPHA,      AX,       AY,       AZ,      DPHI,    022575    70
     1                      EA,    EANT,      EP1,        K,      MANV,    022575    71
     2                   OMEGR,  PDOTAV,   PDOTRX,   PDOTRY,    PDOTRZ,    022575    72
     3                  PDOTST,   PDOTX,    PDOTY,    PDOTZ,     PDOTO,    022575    73
     4                  PHIFOV,   PHIRX,    PHIRY,    PHIRZ,    TACCEL,    022575    74
     5                  THETMX,   THOLD,       TL,    TPMIN,    TSMALL,    022575    75
     6                      XN,     XNN,     XNNN,      XNU,        YN,    022575    76
     7                      ZN                                             022575    77
C                                                                          022575    78
      COMMON /USERR/      ISPT,    ISUB,    KEOPT,   RFIXED,     SLBMX     022575    79
C                                                                          022575    80
      COMMON /USERI/    APOGEE,  CCMRAT,   DIAMAX, EEQWT(9),      EPME,    022575    81
     1                  EQM1WT,  EQM1XL,   EQM1YL,   EQM1ZL,    EQM2WT,    022575    82
     2                  EQM2XL,  EQM2YL,   EQM2ZL,       FE,    IAGNCY,    022575    83
     3         IDEBUG,  ISATOR,  M812SH,   OPTEMP,   ORBINC,    PERIGE,    022575    84
     4          MICRO,   RELME, SPEC(6),    SPEC1,        T,    XCGSA1,    022575    85
     5                    XMER,    XMEU                                    022575    86
C                                                                          022575    87
      COMMON /BTWN/      ACSSN,   ACSWP,      ALT,     AREA,    BATCAP,    022575    88
     1               BITRAT(2),   CLIFE,   CONVWT,   SATDAM,        DT,    022575    89
     2                      DX,      DY,       DZ,    EQBLG,    EQBSID,    022575    90
     3                      FC,      FF,   HARNWT,      HPT,    HTPIPE,    022575    91
     4                    HTPT,  HTRPRB,   HTRPWR,              IBTLOC,    022575    92
     5                   LMBDD,      NC,    OMEGS,   PASSTR,        PJ,    022575    93
     6                      PL,   FLMIN,   POCNWT,     RADA,     RADAB,    022575    94
     7                     RAT,      RJ,   SABOLG,    SATLG,    SATTWT,    022575    95
     8                   SATWT,  SATXCG,   SATYCG,   SATZCG,     SA1XL,    022575    96
     9                   SA1YL,   SA1ZL,     SIDE,    SYSLB,    THCMWT,    022575    97
     A               THRUST(2),      TI,    TNKWT,    TPRIM,        VB,    022575    98
     B                    VCHP,     VOL,     WATE,       WB,       WBT,    022575    99
     C                      WT,      XJ,   XNZERO,       YJ,        ZJ     022575   100
C                                                                          022575   101
C                                                                          121674    44
C *********************************************************************** 121674    45
C **       THE FOLLOWING AREA PRESETS THERMAL CONSTANTS                 ** 121674    46
C *********************************************************************** 121674    47
C                                                                          121674    48
      ALT =(APOGEE + PERIGE) / 2.0                                         010975     3
      IF (ORBINC .NE. -360.) GO TO 200                                     011675     1
      IF (IAGNCY .GT. 1) GO TO 110                                         121674    50
C                                                                          121674    51
      IF (ALT .LT. 500.) ORBINC = 80.                                      121674    52
      IF (ALT .GE.500. .AND. ALT .LE. 19000.) ORBINC = 80.                 121674    53
      IF (ALT .GT. 19000.) ORBINC = 0.0                                    121674    54
      GO TO 200                                                            121674    55
C                                                                          121674    56
  110 IF (ALT .LT. 500.) ORBINC = 35.                                      121674    57
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      IF (ALT .GE. 500. .AND. ALT .LE. 19000.) ORBINC = 80.             121674    58
      IF (ALT .GT. 19000.) ORBINC = 0.0                                 121674    59
C                                                                       121674    60
C *********************************************************************** 121674  61
C **       THE FOLLOWING AREA PRESETS RELIABILITY CONSTANTS           ** 121674   62
C *********************************************************************** 121674  63
C                                                                       121674    64
  200 CONTINUE                                                          121674    65
      BETA = 1.6                                                        121674    66
      B    = 1./BETA                                                    121674    67
      RS1 = T/((-ALOG(SPEC(6)))**B)                                     121674    68
      RS2 = SPEC1/0.88                                                  121674    69
      A = AMAX1(RS1,RS2)                                                121674    70
      IF (SPEC(1) .EQ. -1.) SPEC(1) = EXP(-(T/(3.0*A))**BETA)           121674    71
      IF (SPEC(2) .EQ. -1.) SPEC(2) = EXP(-(T/(5.3*A))**BETA)           121674    72
      IF (SPEC(3) .EQ. -1.) SPEC(3) = EXP(-(T/(3.3*A))**BETA)           121674    73
      IF (SPEC(4) .EQ. -1.) SPEC(4) = EXP(-(T/(3.0*A))**BETA)           121674    74
      IF (SPEC(5) .EQ. -1.) SPEC(5) = EXP(-(T/(4.5*A))**BETA)           121674    75
      IF (RELME   .EQ. -1.) RELME =   EXP(-(T/(1.9*A))**BETA)           011675     2
      RTOT = SPEC(1)*SPEC(2)*SPEC(3)*SPEC(4)*SPEC(5)*RELME              121674    77
      IF (RTOT .GE. SPEC(6)) GO TO 300                                  121674    78
      IF (ISUB .EQ. 0) GO TO 300                                        011275     8
      IERR = -1                                                         121674    79
      RETURN                                                            121674    80
C                                                                       121674    81
C *********************************************************************** 121674  82
C **       THE FOLLOWING AREA PRESETS VEHICLE SIZING CONSTANTS        ** 121674   83
C *********************************************************************** 121674  84
C                                                                       121674    85
  300 CONTINUE                                                          121674    86
C                        * * - - DETERMINE PJ AND RJ - - * *            011275     9
      EQMWT = EQM1WT + EQM2WT                                           010775    10
      DO 305 I = 1,9                                                    010775    11
  305 EQMWT = EQMWT + EEQWT(I)                                          010775    12
      SATWT = 36.9 * EQMWT**.672                                        010775    13
      EQBVOL = 0.1 * SATWT                                              010775    14
      SATDAM = (EQBVOL*2201.)**.333                                     010775    15
      EQBLG  = SATDAM                                                   010775    16
      IF(SATDAM.LE.DIAMAX)GO TO 306                                     010775    17
      SATDAM = DIAMAX                                                   010775    18
      EQBLG = EQBVOL * 2201. /(SATDAM*SATDAM)                           010775    19
  306 SATINX = (SATWT * SATDAM * SATDAM / 8.)                           010775    20
      RJ = SATINX                                                       011275    11
C                                                                       011275    12
C                        * * - - DETERMINE MISSION EQUIPMENT DIMENSIONS - - 011275 13
      IF ( EQM1XL.NE.1.E10.AND.EQM1YL.NE.1.E10.AND.EQM1ZL.NE.1.E10.AND. 011675     3
     *     EQM2XL.NE.1.E10.AND.EQM2YL.NE.1.E10.AND.EQM2ZL.NE.1.E10)     011675     4
     *                    GO  TO  400                                   011675     5
      EQMDEN = 25.0                                                     012775     8
      V1 = EQM1WT/EQMDEN                                                121674    88
      V2 = EQM2WT/EQMDEN                                                121674    89
      IF (MB12SH .LT. 2) GO TO 350                                      121674    90
C                                                                       121674    91
      IF (EQM1YL.EQ.1.E10) EQM1YL = (V1*1728./0.6)**.333                011675     6
      IF (EQM1ZL.EQ.1.E10) EQM1ZL = EQM1YL                              011675     7
      IF (EQM1XL.EQ.1.E10) EQM1XL = 0.6 * EQM1YL                        011675     8
C                                                                       011675     9
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      IF (EQM2YL.EQ.1.E10) EQM2YL = (V2*1728./0.6)**.333                011675  10
      IF (EQM2ZL.EQ.1.E10) EQM2ZL = EQM1YL                              011675  11
      IF (EQM2XL.EQ.1.E10) EQM2XL = 0.6 * EQM2YL                        011675  12
C                                                                       121674  99
      DIAG = EQM1YL/0.707                                               121674 100
C                                                                       121674 101
      IF (DIAG . LT. DIAMAX) GO TO 310                                  121674 102
C                                                                       121674 103
      DIAG  =  DIAMAX                                                   121674 104
C                                                                       121674 105
      EQM1YL =  0.707 * DIAG                                            121674 106
      EQM1ZL =  EQM1YL                                                  121674 107
      EQM1XL = (V1*1728.)/(0.707*DIAG)**2                               121674 108
C                                                                       121674 109
  310 DIAG  =  EQM2YL /0.707                                            121674 110
C                                                                       121674 111
      IF (DIAG .LT. DIAMAX) GO TO 400                                   121674 112
C                                                                       121674 113
      DIAG  =  DIAMAX                                                   121674 114
C                                                                       121674 115
      EQM2YL =  0.707 * DIAG                                            121674 116
      EQM2ZL =  EQM2YL                                                  121674 117
      EQM2XL =  (V2 * 1728.) / (0.707 * DIAG)**2                        121674 118
C                                                                       121674 119
      GO TO 400                                                         121674 120
C                                                                       121674 121
C                                                                       121674 122
C                                                                       121674 123
  350 IF (EQM1YL.EQ.1.E10) EQM1YL = ((V1*1728.)/0.471)**.333            011675  13
      IF (EQM1ZL.EQ.1.E10) EQM1ZL = EQM1YL                              011675  14
      IF (EQM1XL.EQ.1.E10) EQM1XL = 0.6 * EQM1YL                        011675  15
C                                                                       011675  16
      IF (EQM2YL.EQ.1.E10) EQM2YL = ((V2*1728.)/0.471)**.333            011675  17
      IF (EQM2ZL.EQ.1.E10) EQM2ZL = EQM1YL                              011675  18
      IF (EQM2XL.EQ.1.E10) EQM2XL = 0.6 * EQM2YL                        011675  19
      IF (EQM1YL .LT. DIAMAX) GO TO 360                                 121674 128
C                                                                       121674 129
      EQM1YL  = DIAMAX                                                  121674 130
      EQM1ZL  = EQM1YL                                                  121674 131
      EQM1XL  = (V1*1728.) / (0.785* EQM1YL**2)                         121674 132
C                                                                       121674 133
  360 IF (EQM2YL .LT.DIAMAX) GO TO 400                                  121674 134
      EQM2YL = DIAMAX                                                   121674 135
      EQM2ZL = EQM1YL                                                   121674 136
      EQM2XL = (V2 * 1728.) / (0.785*EQM2YL**2)                         121674 137
C                                                                       121674 138
  400 CONTINUE                                                          121674 139
      PJ = EQM1WT * EQM1YL * EQM1YL / 8.0                               021975   2
C                                                                       121674 140
C*********************************************************************** 011275  17
C**      THE FOLLOWING AREA PRESETS S AND C  CONSTANTS               ** 011275  18
C*********************************************************************** 011275  19
C                                                                       011275  20
C                       * * CALCULATE  TACCEL * *                       011275  21
      PDOTMX = AMAX1(PDOTX,PDOTY,PDOTZ)                                 010775  23
      IF (PDOTMX.EQ.0. .AND. TACCEL.EQ.1.E10) GO TO 401                 011575   1
      TMAX = THETMX/PDOTMX                                              010775  24
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      IF (TACCEL.EQ.1.E10) TACCEL = 0.1 * TMAX                010775   25
      GO TO 405                                                011575    2
  401 TACCEL = 0.                                              011575    3
C                          * * CALCULATE  OMEGR   * *          011275   22
  405 IF (OMEGR .NE. 1.E10) GO TO 404                          011575    4
      WR1 = 18000./(RJ/4636.8)                                 011675   20
      WR2 = 90.-((30.*T)/(7.5*12.))                            010775   27
      WR = OMEGR                                               010775   28
      IF(OMEGR.EQ.1.E10)   WR = AMAX1(WR1,WR2)                 010775   29
      IF (WR.GE.60.) GO TO 402                                 010775   30
      WR = 60.                                                 010775   31
      GO TO 403                                                010775   32
  402 IF (WR.LE.90.) GO TO 403                                 010775   33
      WR = 90.                                                 010775   34
  403 OMEGR = WR                                               010775   35
C                          * * CALCULATE  XNN     * *          011275   24
  404 PHIMAX = AMAX1 (PHIRX,PHIRZ)                             011275   25
      HV = RJ/4636.8 * OMEGR * 6.28318 / 60.                   011675   21
      IF (XNN.EQ.1.E10) XNN = 0.0525 * PHIMAX * HV             010775   38
      IERR = 0                                                 121674  141
      RETURN                                                   121674  142
C                                                              121674  143
      END                                                      121674  144
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REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 87

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      SUBROUTINE INITIL(NCONF,IERR)                                     NASA      231
C        THIS SUBROUTINE SETS APPROXIMATIONS FOR ALL VALUES IN BTWN     NASA      232
C        WHICH ARE USED BEFORE THEY ARE CALCULATED                      NASA      233
      DIMENSION NCONF(6)                                                NASA      234
      COMMON /USER1/    ALPHA,       AX,       AY,       AZ,      DPHI, 022575    102
     1                     EA,     EANT,      EP1,        K,      MANV, 022575    103
     2                  OMEGR,   PDOTAV,   PDOTRX,   PDOTRY,    PDOTRZ, 022575    104
     3                 PDOTST,    PDOTX,    PDOTY,    PDOTZ,     PDOTO, 022575    105
     4                 PHIFOV,    PHIRX,    PHIRY,    PHIRZ,    TACCEL, 022575    106
     5                 THETMX,    THOLD,       TL,    TPMIN,    TSMALL, 022575    107
     6                     XN,      XNN,     XNNN,      XNU,        YN, 022575    108
     7                     ZN                                           022575    109
C                                                                       022575    110
      COMMON /USERI/   APOGEE,   COMRAT,   DIAMAX, EEQWT(9),      EPME, 022575    111
     1                 EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,    EQM2WT, 022575    112
     2                 EQM2XL,   EQM2YL,   EQM2ZL,       FE,    IAGNCY, 022575    113
     3         IDEBUG, ISATOR,   MB12SH,   OPTEMP,   ORBINC,    PERIGE, 022575    114
     4          MICRO,  RELME,  SPEC(6),    SPEC1,        T,    XCGSA1, 022575    115
     5                   XMER,     XMEU                                 022575    116
C                                                                       022575    117
      COMMON /BTWN/     ACSSN,    ACSWP,      ALT,     AREA,    BATCAP, 022575    118
     1              BITRAT(2),    CLIFE,   CONVWT,        D,        DT, 022575    119
     2                     DX,       DY,       DZ,   EQBLG,     EQBSID, 022575    120
     3                     FC,       FF,   HARNWT,      HPT,    HTPIPE, 022575    121
     4                   HTPT,   HTRPRB,   HTRPWR,              IBTLOC, 022575    122
     5                  LMBDD,       NC,    OMEGS,   PASSTR,        PJ, 022575    123
     6                     PL,    PLMIN,   POCNWT,     RADA,    RADAB,  022575    124
     7                    RAT,       RJ,   SABOLG,    SATLG,    SATTWT, 022575    125
     8                  SATWT,   SATXCG,   SATYCG,   SATZCG,    SA1XL,  022575    126
     9                  SA1YL,    SA1ZL,     SIDE,    SYSLB,    THCMWT, 022575    127
     A              THRUST(2),       TI,   TNKWT,    TPRIM,        VB,  022575    128
     B                   VCHP,      VOL,     WATE,       WB,       WBT, 022575    129
     C                     WT,       XJ,   XNZERO,       YJ,        ZJ  022575    130
C                                                                       022575    131
      COMMON/PRTCOM/   ACCRCY,       AM,       AN,       BF,        BS, 022575    132
     1              COPI(7,2),   CISTAF,     CTOT,     DDTE,        DE, 022575    133
     2                  DRIWT,   EQBSTR,   FEEINV,   FEEOPS,      FEER, 022575    134
     3                    GSE,     IREL,   ITRUNC,  MMDOLD,NAME(3,60),  022575    135
     4                    OPS,   PAYINV,   PAYQUL,     PAYR,        PE, 022575    136
     5                    PMP,      PMR, POWER(6),       PU,   PWR(60), 022575    137
     6                    QCP,      QCR, ROLD(60),   SABMWT,    SATADP, 022575    138
     7                 SATINV,     SATR,     SEIP,     SEIR, SKTAU(6),  022575    139
     8               SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7),  022575    140
     9                     TA, TAU(6,6),       TB,       TC,        TE, 022575    141
     A                     TF,    TOOLR,    TOOLU,   TOTOPS,     TRUNC, 022575    142
     B                     TS,      TTT,VOLUME(6), VOL(60),WEIGHT(6),   022575    143
     C                 XLTOT,     XMEH,   XMEINV,     XMEL,     XMEVL,  022575    144
     D                   XMEW,    XMEWT,    XVEST                       022575    145
      IERR=0                                                            NASA      253
      ACCRCY=AMIN1(PHIRX,PHIRY,PHIRZ)                                   NASA      254
      EQMWT=EQM1WT+EQM2WT                                               NASA      255
      DO 1 I=1,9                                                        NASA      256
    1 EQMWT=EQMWT+EEQWT(I)                                              NASA      257
      SATWT=36.9*EQMWT**.672                                            NASA      258
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      EQBVOL=.1*SATWT                                                   NASA       259
      SATXCG = 500. + EQBLG * 0.5                                       011275      28
      SATYCG = 0.                                                       010675       8
      SATZCG = 0.                                                       010675       9
      SA1XL = 96.                                                       010675      10
      PS= (EPME+200.)*2.4                                               010675      11
      SA1YL =.1033*PS                                                   010675      12
      SA1ZL = 1.0                                                       010675      13
      TPRIM=T                                                           NASA       260
      N=NCONF(6)                                                        NASA       261
      GO TO (20,10,30) ,N                                               NASA       262
C        HERE IF A BOX                                                  NASA       263
   10 EQBLG=(EQBVOL* 3456.)**.333                                       NASA       264
      EQBDIA=EQBLG                                                      NASA       265
      EQBSID=.707*EQBDIA                                                NASA       266
      IF (EQBDIA .LE. DIAMAX) GO TO 11                                  NASA       267
      EQBDIA=DIAMAX                                                     NASA       268
      EQBSID=.707*EQBDIA                                                NASA       269
      EQBLG=(EQBVOL*1728.)/(EQBSID*EQBSID)                              NASA       270
   11 SATINX=(SATWT/6.)*EQBSID*EQBSID                                   NASA       271
      SATINY=(SATWT/12.)*(EQBSID*EQBSID+EQBLG*EQBLG)                    NASA       272
      SATINZ=SATINY                                                     NASA       273
      SATDAM=EQBDIA                                                     NASA       274
      GO TO 100                                                         NASA       275
C        HERE IF A CYLINDER                                             NASA       276
   20 SATDAM=(EQBVOL*2201.)**.333                                       NASA       277
      EQBLG=SATDAM                                                      NASA       278
      IF (SATDAM .LE. DIAMAX) GO TO 21                                  NASA       279
      SATDAM=DIAMAX                                                     NASA       280
      EQBLG=EQBVOL*2201./(SATDAM*SATDAM)                                NASA       281
   21 SATINX=(SATWT*SATDAM*SATDAM/8.)                                   NASA       282
      SATINY=(SATWT/12.)*(.75*SATDAM*SATDAM+EQBLG*EQBLG)                NASA       283
      SATINZ=SATINX                                                     NASA       284
      GO TO 100                                                         NASA       285
C        HERE IF A SPHERE                                               NASA       286
   30 SATDAM=(EQBVOL*3300.9)**.333                                      NASA       287
      SATINX=.1*SATWT*SATDAM*SATDAM                                     NASA       288
      SATINY=SATINX                                                     NASA       289
      SATINZ=SATINX                                                     NASA       290
C       IF SATDAM TOO BIG STOP PROGRAM                                  NASA       291
      IF (SATDAM .GT. DIAMAX) IERR=1                                    NASA       292
      IF (IERR .GT. 0) RETURN                                           NASA       293
      GO TO 100                                                         NASA       294
C        SETS VALUES NEEDED BY S AND C                                  NASA       295
  100 IF (NCONF(1) .NE. 1) GO TO 120                                    NASA       296
      XJ = SATINX                                                       011075       1
      YJ = SATINY                                                       011075       2
      ZJ = SATINZ                                                       011075       3
      RJ = SATINX                                                       011075       4
      DX=.5*SATDAM/12.                                                  NASA       298
      GO TO 200                                                         NASA       299
  120 IF (NCONF(1) .NE. 2) GO TO 130                                    NASA       300
      XJ=SATINX                                                         NASA       301
      YJ=SATINY                                                         NASA       302
      ZJ=SATINZ                                                         NASA       303
      D=SATDAM                                                          NASA       304
      CZ=.5*SATDAM                                                      NASA       305
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      OMEGS = 6.28318 / TPMIN                                  010775    40
      HW = SATINX * OMEGS                                      010775    41
      IF (HW.LT.500) GO TO 125                                 010775    42
      IERR = -1                                                010775    43
  125 IF (NCONF(6).EQ.2) GO TO 200                             010775    44
      IF (NCONF(6) .EQ. 1) DT=.5*EQBLG                         NASA     307
      IF (NCONF(6) .EQ. 3) DT=.5*SATDAM                        NASA     308
      DX=DT                                                    NASA     309
      DY=DT                                                    NASA     310
      GO TO 200                                                NASA     311
  130 IF(NCONF(1) .GT. 5) GO TO 200                            NASA     312
      XJ=SATINX                                                NASA     313
      YJ=SATINY                                                NASA     314
      ZJ=SATINZ                                                NASA     315
      D=SATDAM                                                 NASA     316
      IF (NCONF(6).EQ. 2) D=EQBCIA                             NASA     317
      DT=.5*EQBLG                                              NASA     318
      IF (NCONF(6) .EQ. 3) DT=.5*SATDAM                        NASA     319
      DX=.5*SATDAM                                             NASA     320
      IF (NCONF(6) .EQ. 2) DX=.5*EQBLG                         NASA     321
      DY=DT                                                    NASA     322
      DZ=DT                                                    NASA     323
  200 CONTINUE                                                 NASA     324
       RETURN                                                  NASA     326
      END                                                      NASA     327
REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 52
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      BLOCK DATA                                                        NASA     328
C        SETS ALL DEFAULT VALUES                                        NASA     329
      COMMON /USER1/     ALPHA,       AX,       AY,       AZ,     DPHI, 022575   146
     1                      EA,     EANT,      EP1,        K,     MANV, 022575   147
     2                   OMEGR,   PDOTAV,   PDOTRX,   PDOTRY,   PDOTRZ, 022575   148
     3                  PDOTST,    PDOTX,    PDOTY,    PDOTZ,    PDOT0, 022575   149
     4                  PHIFOV,    PHIRX,    PHIRY,    PHIRZ,   TACCEL, 022575   150
     5                  THETMX,    THOLD,       TL,    TPMIN,   TSMALL, 022575   151
     6                      XN,      XNN,     XNNN,      XNU,       YN, 022575   152
     7                      ZN                                          022575   153
C                                                                       022575   154
      COMMON /USER3/ARRAYN(11,3), BTRMX,    NMSEQ,    OPSMS,    SCSFL, 022575   155
     1                   TPRFL                                          022575   156
C                                                                       022575   157
      COMMON /USER4/BWIDTH(2),  FREQ(2),    FREQR,   IOPTCM,     LINK, 032475     2
     1                   NADIR,      NET                                022575   159
C                                                                       022575   160
      COMMON /USER6/ CGEEX(9), EELCC(9), EEQVL(9),   EM1YCG,   EM1ZCG, 022575   161
     1          EQPF,   EM2YCG,   EM2ZCG,   ISBOFG,   NUMEEQ,   XCGSA3 022575   162
C                                                                       022575   163
      COMMON /USER8/SKDME(7,3)                                          022575   164
C                                                                       022575   165
      COMMON /USER9/        CA,       CE                                022575   166
C                                                                       022575   167
      COMMON /USERI/    APOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME, 022575   168
     1                  EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT, 022575   169
     2                  EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY, 022575   170
     3        IDEBUG,   ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE, 022575   171
     4         MICRO,    RELME,  SPEC(6),    SPEC1,        T,   XCGSA1, 022575   172
     5                    XMER,     XMEU                                022575   173
C                                                                       022575   174
      COMMON /USERC/    FEEPCT,   IMETYP,      NFV,      NQV,       PI  022575   175
      COMMON /USERR/      ISPT,     ISUB,   KEOPT,   RFIXED,    SLBMX  022575   176
C                                                                       022575   177
      COMMON /BTWN/      ACSSN,    ACSWP,      ALT,     AREA,   BATCAP, 022575   178
     1              BITRAT(2),    CLIFE,   CONVWT,        D,       DT, 022575   179
     2                      DX,       DY,       DZ,    EQBLG,   EQBSID, 022575   180
     3                      FC,       FF,   HARNWT,      HPT,   HTPIPE, 022575   181
     4                    HTPT,   HTRPRB,   HTRPWR,                IBTLOC, 022575   182
     5                   LMBDD,       NC,    OMEGS,   PASSTR,       PJ, 022575   183
     6                      PL,    PLMIN,   POCNWT,     RADA,    RADAE, 022575   184
     7                     RAT,       RJ,   SABOLG,    SATLG,   SATTWT, 022575   185
     8                   SATWT,   SATXCG,   SATYCG,   SATZCG,   SA1XL, 022575   186
     9                   SA1YL,    SA1ZL,     SIDE,    SYSLB,   THCMWT, 022575   187
     A              THRUST(2),       TI,    TNKWT,    TPRIM,       VB, 022575   188
     B                    VCHP,      VOL,     WATE,       WB,      WBT, 022575   189
     C                      WT,       XJ,   XNZERO,       YJ,       ZJ  022575   190
C                                                                       022575   191
      DATA DPHI,FE,TSMALL,XNU,PDOT0,T/.25,4.1,100.,3.,1.,24./           011275    30
      DATA PHIRX,PHIRY,PHIRZ,PDOTX,PDOTY,PDOTZ,XN,YN,ZN,PDOTRX,PDOTRY,  NASA     351
     *PDOTRZ/3*.75,6*1.,3*.012/                                         NASA     352
      DATA OMEGS,OMEGR,PJ,XNN,K,MANV /1.5708,1.E10,75.,1.E10,1,1/      022675     4
      DATA EP1,AX,AY,AZ/.0001,3*.05/                                    NASA     354
      DATA THETMX,TPMIN /180.,10./                                      011775     1
```

```
      DATA EA,EANT,ALPHA,TL,TACCEL,XNNN,THOLD,PDOTAV,PDOTST,PHIFOV          NASA       355
     * /.1,.1,12.,1.,1.E10,4.,100000.,.01,.0667,40./                        010975       8
      DATA CLIFE/50000./                                                    NASA       357
      DATA MICRO,IAGNCY /0,1/                                               022675       5
      DATA BTRMX,SCSFL,TPRFL,OPSMS,ARRAYN,NMSEQ/1.024E6,6*0.,2*106.,        032475       3
     *                  500.,8.,2*280.,1.,8.,22*0.,0/                       032475       4
      DATA IVOLT,OPTEMP,EPME /0,15.,200./                                   021975       3
      DATA IOPTCM,LINK,FREQ,NET,NADIR,FREQR,COMRAT,BWIDTH                   011475      10
     *     /0,1,2*2250.,2*0,1800.,1000.,2*-1.E10/                           032475       5
      DATA EQPF,MB12SH,EQM1XL,EQM1YL,EQM1ZL,EQM2XL,EQM2YL /4.95,1,          121674     145
     * 5*1.E10/                                                             011675      24
      DATA EQM2ZL,IS8OFG,NUMEEQ,EEQWT,EEQVL,EM1YCG,EM1ZCG,EM2YCG            NASA       365
     * /1.E10,2*0,21*0./                                                    011675      25
      DATA EM2ZCG,CGEEX,EELOC,XCGSA1,XCGSA3 /0.,9*2.,9*3.,2*1./             NASA       367
      DATA ISATOR,ORBINC,IAGNCY/1,-360.,1/                                  021975       4
       DATA SKOME/21*0./                                                    NASA       369
       DATA CA,CE/10.,5./                                                   NASA       370
      DATA EQM1WT,EQM2WT,DIAMAX,APOGEE,PERIGE,MICRO/2*435.,120.,2*500.,     021975       5
     *     0/                                                               021975       6
      DATA KEOPT,RFIXED,SLBMX,ISPT,SPEC,SPEC1,ISUB,RELME / 1,               011675      26
     * 1.,50000.,0,5*(-1.),0.6,18.,0,-1./                                   021975       7
      DATA NFV,NQV,XMER,XMEU,FEEPCT,IMETYP,PI /4,1,0.,0.,0.07,2,1./         121174       1
      END                                                                   NASA       375
```

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      SUBROUTINE COSTS (NCONF,NEQUIP)                                   NASA        376
C ******************************************************************** NASA        377
C **   THIS SUBROUTINE COLLECTS COSTS FOR CATALOG ITEMS AND CALCULATES ** NASA      378
C **   COSTS FOR CER ITEMS AND STORES THEM FOR OUTPUTTING              ** NASA      379
C ******************************************************************** NASA        380
C                                                                       NASA        381
      COMMON /USERC/    FEEPCT,   IMETYP,      NFV,      NQV,       PI  022575      192
C                                                                       022575      193
      COMMON /USERI/    APOGEE,   CCMRAT,   DIAMAX, EEQWT(9),     EPME, 022575      194
     1                  EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT, 022575      195
     2                  EQM2XL,   EQM2YL,   EQM2ZL,    XDUM1,   IAGNCY, 022575      196
     3         IDEBUG,  ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE, 022575      197
     4          MICRO,   RELME,  SPEC(6),    SPEC1,    XDUM2,   XCGSA1, 022575      198
     5                    XMER,     XMEU                                022575      199
C                                                                       022575      200
      COMMON /BTWN/       ACSSN,    ACSWP,      ALT,     AREA,   BATCAP, 022575     201
     1               BITRAT(2),   CLIFE,   CONVWT,        D,       DT, 022575      202
     2                      DX,       DY,       DZ,    EQBLG,   EQBSID, 022575      203
     3                      FC,       FF,   HARNWT,      HPT,   HTPIPE, 022575      204
     4                    HTPT,   HTRFRB,   HTRPWR,               IBTLOC, 022575      205
     5                   LMBDD,       NC,    OMEGS,   PASSTR,       PJ, 022575      206
     6                      PL,    PLMIN,   POCNWT,     RADA,    RADAE, 022575      207
     7                     RAT,       RJ,   SABOLG,    SATLG,   SATTWT, 022575      208
     8                   SATWT,   SATXCG,   SATYCG,   SATZCG,   SA1XL, 022575      209
     9                   SA1YL,    SA1ZL,     SIDE,    SYSLB,   THCMWT, 022575      210
     A               THRUST(2),       TI,    TNKWT,    TPRIM,       VB, 022575      211
     B                    VCHP,      VOL,     WATE,       WB,      WBT, 022575      212
     C                      WT,       XJ,   XNZERO,       YJ,       ZJ  022575      213
C                                                                       022575      214
      COMMON /CHOSE/      COST(5,60),      DPIA(11,60),     ICHOSE(60), 022575      215
     1                    NCHOSE(60),      REL ( 6,60),     SKD(7,60),  022575      216
     2                    THM(4,60)                                     022575      217
C                                                                       022575      218
      COMMON/PRTCOM/    ACCRCY,       AM,       AN,       BF,       BS, 022575      219
     1               CDPI(7,2),   CISTAR,     CTOT,     DDTE,       DE, 022575      220
     2                   DRIWT,   EQBSTR,   FEEINV,   FEEOPS,     FEER, 022575      221
     3                     GSE,     IREL,   ITRUNC,   MMDOLD,NAME(3,60), 022575     222
     4                     OPS,   PAYINV,   PAYQUL,     PAYR,       PE, 022575      223
     5                     PMP,      PMR, POWER(6),       PU,  PWR(60), 022575      224
     6                     QCU,      QCR, ROLD(60),   SABMWT,   SATADP, 022575      225
     7                  SATINV,     SATR,     SEIP,     SEIR,  SKTAU(6), 022575     226
     8                SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7), 022575      227
     9                      TA, TAU(6,6),       TB,       TC,       TE, 022575      228
     A                      TF,    TOOLR,    TOOLU,   TOTOPS,    TRUNC, 022575      229
     B                      TS,      TTT,VOLUME(6),  VQL(60),WEIGHT(6), 022575      230
     C                  XLTOT,     XMEH,   XMEINV,     XMEL,    XMEVL, 022575      231
     D                   XMEW,    XMEWT,    XVEST                       022575      232
      DIMENSION      RE(7),RT(7),RP(7),BE(7),BT(7),BP(7),               NASA        397
     1               X(7),FP(7),FT(7),FE(7),NCONF(7),NEQUIP(5),         NASA        398
     2 COMPR(60),COMPU(60),SUBR(7),                                     111974       17
     3 SUBU(7),COMP5E(60),COMP5P(60),                                   111974       18
     4               SUB5P(7),SUB5E(7),MEQUIP(5)                        NASA        401
C                                                                       NASA        402
      DATA                                                              NASA        403
```

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     1                  FP          /7*1./,                                           101774      1
     2                  FT          /7*1./,                                           101774      2
     3                  FE          /7*1./,                                           101774      3
     4                  RE          /41500.,3920.,91287.,82800.,129200.,              NASA      407
     5                              139000.,51383./,                                  NASA      408
     6                  RT          /34100.,6000.,69338.,48640.,24160.,               NASA      409
     6                              48900.,87500./,                                   NASA      410
     7                  RP          /42678.,2050.,9400.,14870.,14000.,                NASA      411
     7                              53545.,36660./,                                   NASA      412
     8                  BE          /.627,.715,.500,.620,.272,.393,.587/,             NASA      413
     9                  BT          /.500,.585,.500,.620,.675,.410,.301/,             NASA      414
     A                  BP          /.444,.745,.566,.738,.668,.263,.182/,             NASA      415
     B                  SF          /1.0/                                             121174      2
      SEIR = 0.                                                                       NASA      417
      QCR = 0.                                                                        NASA      418
      PMR = 0.                                                                        NASA      419
      SUMTDE = 0.                                                                     NASA      420
      TOOLR = 0.                                                                      NASA      421
      SEIP = 0.                                                                       NASA      422
      QCU = 0.                                                                        NASA      423
      PMP = 0.                                                                        NASA      424
      SUMPE = 0.                                                                      NASA      425
      TOTSUM = 0.                                                                     NASA      426
      SATR = 0.                                                                       NASA      427
      SATINV = 0.                                                                     NASA      428
      XMEINV = 0.                                                                     022675      6
      PAYR = 0.                                                                       NASA      430
      PAYINV =0.                                                                      NASA      431
      PAYQUL = 0.                                                                     NASA      432
      GSE = 0.                                                                        NASA      433
      XLTOT = 0.                                                                      NASA      434
      CTOT = 0.                                                                       NASA      435
      FEER = 0.                                                                       NASA      436
      FEEINV= 0.                                                                      NASA      437
      DDTE = 0.                                                                       NASA      438
      XVEST = 0.                                                                      NASA      439
      OPS = 0.                                                                        NASA      440
      DE = 0.                                                                         NASA      441
      TE = 0.                                                                         NASA      442
      PE = 0.                                                                         NASA      443
      PU = 0.                                                                         NASA      444
      SYSR=0.                                                                         NASA      445
      SYSU=0.                                                                         NASA      446
      Q5=0.                                                                           NASA      447
      P5P=0.                                                                          NASA      448
      P5E=0.                                                                          NASA      449
      IBTFRS=1                                                                        NASA      450
      ITHRST=1                                                                        NASA      451
      DO 1 I=1,7                                                                      NASA      452
      SUB5P(I)=0.                                                                     NASA      453
      SUB5E(I)=0.                                                                     NASA      454
      SUBE(I)= 0.                                                                     NASA      455
      SUBT(I)= 0.                                                                     NASA      456
      SUBR(I)= 0.                                                                     NASA      457
      SUBUE(I)=0.                                                                     NASA      458
      SUBUP(I)=0.                                                                     NASA      459
    1 SUBU(I) =0.                                                                     NASA      460
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      DO 2 I=1,60                                                       NASA     461
      COMP5E(I)=0.                                                      NASA     462
      COMP5P(I)=0.                                                      NASA     463
      COMPU(I)=0.                                                       NASA     464
    2 COMPR(I)=0.                                                       NASA     465
      MEQUIP(1)=NEQUIP(1)                                               NASA     466
      DO 3 J=2,5                                                        NASA     467
    3 MEQUIP(J)=MEQUIP(J-1)+NEQUIP(J)                                   NASA     468
      X(1) = WATE                                                       NASA     469
      X(2) = HARNWT                                                     NASA     470
      X(3) = THCMWT                                                     NASA     471
      X(4) = CONVWT                                                     NASA     472
      X(5) = WEIGHT(2)                                                  120474     2
      X(6) = PASSTR                                                     NASA     474
      X(7) = POCNWT                                                     NASA     475
      PRINT 9004,(X(I),I=1,7)                                           101874     1
 9004 FORMAT (10E11.4)                                                  101874     2
C                                                                       NASA     476
      I=1                                                               NASA     477
      J=1                                                               NASA     478
C                                                                       NASA     479
  100 IF (NCHOSE(I).EQ.0) GO TO 200                                     NASA     480
C                                                                       NASA     481
C                                                                       NASA     482
C  ** COMPUTATIONS FOR CATALOG ITEMS                                    NASA     483
C                                                                       NASA     484
C                                                                       NASA     485
      IF (I .GT. MEQUIP(J))  J=J+1                                      NASA     486
      ICHS = ICHOSE(I)/100                                              NASA     487
      XFP = 1.                                                          NASA     488
      XFE = 1.                                                          NASA     489
      XFT = 1.                                                          NASA     490
      C1= COST(1,I)                                                     NASA     491
      Q =NQV +NFV                                                       NASA     492
      QP = Q * NCHOSE(I)                                                NASA     493
      Q5=5.*NCHOSE(I)                                                   NASA     494
      P5 = COST (3,I)                                                   NASA     495
      QREF = COST(4,I)                                                  NASA     496
      FQ = NCHOSE(I)/QREF                                               NASA     497
      IF (FQ.LT.1.) FQ = 1.                                             NASA     498
      FRE = 0.8875 + 0.1125*FQ                                          NASA     499
      FRT = 0.3    + 0.7*FQ                                             NASA     500
      GO TO (110,120,130,140,150),J                                     NASA     501
C     SET SCALE FACTORS FOR S ^ C CATALOG ITEMS                         NASA     502
  110 GO TO (170,170,111,170,170,170,170,115,111,170,170,               NASA     503
     *       115,170,170,170,170,170,115,170,170,170,170),ICHS          NASA     504
  111 IF (NCONF(1) .LE. 1) GO TO 170                                    NASA     505
      IF (NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)GO TO 112     NASA     506
      XFP = 3.3                                                         NASA     507
      GO TO 170                                                         NASA     508
  112 XFP = 7.5                                                         NASA     509
      GO TO 170                                                         NASA     510
C                                                                       NASA     511
  115 IF (NCONF(1) .LE. 1) GO TO 170                                    NASA     512
      IF (NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)GO TO 117     NASA     513
      XFE = 13.5                                                        NASA     514
      XFT = 2.4                                                         NASA     515
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            XFP = 2.2                                                        NASA      516
            GO TO 170                                                        NASA      517
      C                                                                      NASA      518
        117 XFE = 13.5                                                       NASA      519
            XFT = 2.4                                                        NASA      520
            XFP = 5.0                                                        NASA      521
            GO TO 170                                                        NASA      522
      C                                                                      NASA      523
      C      SET SCALE FACTORS FOR AUXPRO CATALOG ITEMS                      NASA      524
        120 GO TO (121,180,180,170,180,180,180,121,180,180,180,180,          NASA      525
           *       121,180,180,180,180),ICHS                                 NASA      526
        121 IF (ITHRST .GT. 1) GO TO 122                                     NASA      527
            ITHRST = ITHRST + 1                                              NASA      528
            IF (THRUST(1).LT.REL(1,I)) XFT = 0.25                            NASA      529
            GO TO 170                                                        NASA      530
        122 IF (THRUST(2).LT.REL(1,I)) XFT = 0.25                            NASA      531
            GO TO 170                                                        NASA      532
      C                                                                      NASA      533
      C     SET SCALE FACTORS FOR DPI CATALOG ITEMS                          NASA      534
      C                                                                      NASA      535
        130 GO TO (170,131),ICHS                                             NASA      536
        131 GO TO (136,132,132,134),IMETYP                                   121174      3
        132 XFT = 1.9                                                        NASA      538
            XFP = 3.0                                                        NASA      539
            GO TO 136                                                        NASA      540
        134 XFT = 1.9                                                        NASA      541
            XFP = 4.5                                                        NASA      542
      C                                                                      NASA      543
        136 IF (IBTFRS.GT.1) GO TO 138                                       NASA      544
            IBTFRS = IBTFRS + 1                                              NASA      545
            IF (BITRAT(1) .GT. 100000.) XFE = 2.7                            NASA      546
            GO TO 170                                                        NASA      547
      C                                                                      NASA      548
        138 IF (BITRAT(2) .GT. 100000.) XFE = 2.7                            NASA      549
            GO TO 170                                                        NASA      550
      C                                                                      NASA      551
      C     SET SCALE FACTORS FOR COMM CATALOG FACTORS                       NASA      552
      C        (NONE NEEDED AT THIS TIME)                                    NASA      553
        140 IF (ICHS.EQ.7) GO TO 180                                         111874     32
            GO TO 170                                                        111874     33
      C                                                                      NASA      555
      C     SET SCALE FACTORS FOR E.P. CATALOG ITEMS                         NASA      556
      C                                                                      NASA      557
        150 GO TO (180,151,180,180,180,180,180,180,180,180,180,180),ICHS     NASA      558
        151 IF (BATCAP .LE. 15.) GO TO 155                                   NASA      559
            IF (NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)XFE=2.3645   NASA      560
      C                                                                      NASA      561
        155 IF (NCONF(5).EQ.2.OR.NCONF(5).EQ.4.OR.NCONF(5).EQ.6)GO TO 170    NASA      562
            XFT = 6.                                                         NASA      563
            XFP = 4.                                                         NASA      564
            GO TO 170                                                        NASA      565
      C                                                                      NASA      566
      C                                                                      NASA      567
      C                                                                      NASA      568
      C  ** COMPUTE DESIGN ENGINEERING COST, (DE OR COMPE)                   NASA      569
        170 COST(1,I)=COST(1,I)*PI*FRE*1000.*XFE                             NASA      570
      C  ** COMPUTE TEST AND EVALUATION COST, (TE OR COMPT)                  NASA      571
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      COST(2,I)=COST(2,I)*PI*FRT*1000.*XFT                              NASA     572
C   ** SUB-TOTAL ENGINEERING COSTS                                      NASA     573
      COMPR(I)= COST(1,I) + COST(2,I)                                   NASA     574
C   ** COMPUTE COMPONENT AVERAGE UNIT PRODUCTION COST,(PU OR COMPUP)    NASA     575
      COST(3,I) = 1.277*P5*QP**.848*PI*1000.*XFP/Q                      NASA     576
C   ** COMPUTE COMPONENT CUM AVG 5 UNIT PROD. COST                      NASA     577
      COMP5P(I) = 200.* P5 * Q5**0.848 * PI * 1.277*XFP                 NASA     578
C   ** COMPUTE COMPONENT AVERAGE PRODUCTION ENGINEERING (PE.OR COMPUE)  NASA     579
      COST(4,I) = C1*(QP**.485-1.)*PI*FRE*1000.*XFE/Q                   NASA     580
C   ** COMPUTE COMPONENT CUM AVG 5 PROD. ENG. COST                      NASA     581
      COMP5E(I) = 200. * C1 * (Q5**0.485 - 1.0) * FRE * PI * XFE        NASA     582
      COMPU(I) = COST(3,I) + COST(4,I)                                  NASA     583
      GO TO 185                                                         101874     3
  180 CONTINUE                                                          101874     4
      DO 183 JJJ=1,5                                                    101874     5
  183 COST(JJJ,I) = 0.0                                                 101874     6
C                                                                       101874     7
  185 CONTINUE                                                          101874     8
      IF(IDEBUG.EQ.1)PRINT 9000,(COST(JJ,I),JJ=1,4),COMPR(I),COMPU(I),  012775    12
     *                            COMP5P(I),COMP5E(I)                   012775    13
      I = I + 1                                                         101574    18
      GO TO 100                                                         NASA     587
C                                                                       NASA     588
C                                                                       NASA     589
C                                                                       NASA     590
C                                                                       NASA     591
C   ** COMPUTATIONS FOR SUBSYSTEM COSTS BASED ON COST ESTIMATING        NASA     592
C   ** RELATIONSHIPS (C.E.R.-S)                                         NASA     593
  200 M = 0                                                             NASA     594
      J = I + 6                                                         NASA     595
      ISAVE = I                                                         NASA     596
      PRINT 9993                                                        NASA     597
 9993 FORMAT(//)                                                        NASA     598
C                                                                       NASA     599
      DO 300 K = I,J                                                    NASA     600
      M = M + 1                                                         NASA     601
C                                                                       NASA     602
      FE(M) = 1.                                                        NASA     603
      FT(M) = 1.                                                        NASA     604
      FP(M) = 1.                                                        NASA     605
      GO TO (205,210,215,220,225,230,235),M                             NASA     606
C                                                                       NASA     607
C     SET SOLAR ARRAY CER FACTORS                                       NASA     608
C                                                                       NASA     609
  205 GO TO (207,207,206,206),IMETYP                                    121174     4
  206 FE(M) = 4.0                                                       NASA     612
      FT(M) = 4.0                                                       NASA     613
  207 IF (NCONF(5).EQ.2.OR.NCONF(5).EQ.4.OR.NCONF(5).EQ.6)GO TO 270     NASA     614
      FP(M)=2.0                                                         NASA     617
      GO TO 270                                                         120474     3
C                                                                       NASA     618
C     SET WIRING HARNESS CER FACTORS                                    NASA     619
  210 FE(M)=5.0                                                         NASA     620
      FT(M)=5.0                                                         NASA     621
      FP(M)=3.0                                                         NASA     622
      GO TO 270                                                         NASA     623
C                                                                       NASA     624
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C     SET THERMAL CER FACTORS                                           NASA     625
C                                                                       NASA     626
  215 IF (NCONF(1).NE.1) FE(M)=2.0                                      NASA     627
      IF (NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)FP(M)=2.0     NASA     628
      GO TO 270                                                         NASA     629
C                                                                       NASA     630
C     SET POWER CONVERTERS CER FACTORS                                  NASA     631
C        (NONE NEEDED AT THIS TIME)                                     NASA     632
C                                                                       NASA     633
  220 GO TO 270                                                         NASA     634
C                                                                       NASA     635
C     SET PROPELLANT FEED SYSTEM CER FACTORS                            NASA     636
C                                                                       NASA     637
  225 IF (NCONF(1).GT.1) GO TO 226                                      NASA     638
      RE(M)=129200.                                                     NASA     639
      BE(M)=.272                                                        NASA     640
      FE(M)=0.507                                                       NASA     641
      FT(M)=0.325                                                       NASA     642
      FP(M)=0.615                                                       NASA     643
      GO TO 270                                                         NASA     644
C                                                                       NASA     645
  226 RE(M)=545640.                                                     NASA     646
      BE(M)=0.222                                                       NASA     647
      FE(M)=0.268                                                       NASA     648
      FT(M)=0.619                                                       NASA     649
      FP(M)=0.840                                                       NASA     650
      GO TO 270                                                         NASA     651
C                                                                       NASA     652
C     SET STRUCTURES CER FACTORS                                        NASA     653
C                                                                       NASA     654
  230 STRF=0.5054*SATWT**(-0.168)                                       120474     4
      RATIO = PASSTR/SATWT                                              NASA     656
      IF(STRF.GE.RATIO) STF=1.+(STRF-RATIO)/STRF                        NASA     657
      IF(STRF.LT.RATIO) STF=1.-(RATIO-STRF)/RATIO                       NASA     658
C                                                                       NASA     659
      PRINT 9001,STF                                                    032475     6
 9001 FORMAT(1X,5HSTF =,E11.4)                                          032475     7
      IF (NCONF(5).EQ.2.OR.NCONF(5).EQ.4.OR.NCONF(5).EQ.6)GO TO 231     NASA     662
      FE(M)=2.5                                                         NASA     663
      FT(M) = 3.0                                                       120474     5
      FP(M)=4.0                                                         NASA     664
C                                                                       NASA     665
  231 FE(M)=FE(M)*STF                                                   NASA     666
      FT(M)=FT(M)*STF                                                   NASA     667
      GO TO 270                                                         NASA     668
C                                                                       NASA     669
C     SET POWER CONTROL EQUIPMENT CER FACTORS                           NASA     670
C                                                                       NASA     671
  235 IF (NCONF(5).EQ.2 .OR. NCONF(5).EQ.4 .OR.NCONF(5).EQ.6) GO TO 270 120474     6
      FE(M) = 3.2                                                       120474     7
      FT(M)=3.1                                                         NASA     675
      FP(M)=4.0                                                         NASA     676
      GO TO 270                                                         NASA     677
  270 COMPER = RE(M) * X(M)**BE(M) * FE(M)                              120474     8
      IF (M.EQ.1) COMPER = (FE(M)*RE(M)*AREA**BE(M))                    NASA     679
     1                   - (FT(M)*RT(M)*X(M)**BT(M))                    NASA     680
C     DESIGN ENGINEERING COSTS (COMPE OR DE)                            NASA     681
```

```
      COST(1,K) = COMPER * SF * PI                                        120474      9
C     TEST + EVALUATION COSTS  (COMPT OR TE)                              NASA      683
      IF(M.EQ.5) X(M) = DRIWT                                             120474     10
      COST(2,K) = RT(M)*X(M)**BT(M)*SF*PI*FT(M)                           NASA      684
C     SUBTOTAL                                                            NASA      685
      COMPR(K) = COST(1,K) + COST(2,K)                                    NASA      686
C     UNIT PRODUCTION COST                                                NASA      687
      COST(3,K) = RP(M)*X(M)**BP(M)*SF*PI*Q**(-.152)*FP(M)*1.277          NASA      688
      IF (M.EQ.1) COST(3,K) = RP(M)*AREA**BP(M)*SF*PI*Q**(-0.152)         NASA      689
     1                        *FP(M)*1.277                                NASA      690
C     UNIT ENGINEERING COSTS                                              NASA      691
      COST(4,K)=COMPER*(Q**.485-1.)*SF*PI/Q                               120474     11
C  ** COMPUTE COMPONENTCUM AVG 5 UNIT PROD. COST                          NASA      693
      COMP5P(K) = 0.783 * COST(3,K) * Q**0.152                            NASA      694
C  ** COMPUTE COMPONENT CUM AVG 5 PROD. ENG COST                          NASA      695
      COMP5E(K) = 0.2365 * COMPER*SF*PI*FE(M)                             NASA      696
C                                                                         NASA      697
C     SUBTOTAL PRODUCTION                                                 NASA      698
      COMPU(K) = COST(3,K) + COST(4,K)                                    NASA      699
C                                                                         NASA      700
      IF(IDEBUG.EQ.1)PRINT 9000,(COST(JJ,K),JJ=1,4),COMPR(K),COMPU(K),    012775     14
     *                          COMP5P(K),COMP5E(K)                       012775     15
      GO TO (280,280,281,280,282,283,280),M                               NASA      703
C                                          ** EP CER  SUB-TOTALING        NASA      704
  280 SUBE(5) = SUBE(5) + COST(1,K)                                       NASA      705
      SUBT(5) = SUBT(5) + COST(2,K)                                       NASA      706
      SUBR(5) = SUBR(5) + COMPR(K)                                        NASA      707
      SUBUE(5)= SUBUE(5)+COST(4,K)                                        112574      1
      SUBUP(5)= SUBUP(5)+COST(3,K)                                        112574      2
      SUBU(5) = SUBU (5)+ COMPU(K)                                        NASA      710
      SUB5E(5) = SUB5E(5) + COMP5E(K)                                     NASA      711
      SUB5P(5) = SUB5P(5) + COMP5P(K)                                     NASA      712
      GO TO 300                                                           NASA      713
C                                   ** THERMAL CER SUB-TOTAL              NASA      714
  281 SUBE(7) = SUBE(7) + COST(1,K)                                       NASA      715
      SUBT(7) = SUBT(7) + COST(2,K)                                       NASA      716
      SUBR(7) = SUBR(7) + COMPR(K)                                        NASA      717
      SUBUE(7)= SUBUE(7)+COST(4,K)                                        112574      3
      SUBUP(7)= SUBUP(7)+COST(3,K)                                        112574      4
      SUBU(7) = SUBU(7) + COMPU(K)                                        NASA      720
      SUB5E(7) = SUB5E(7) + COMP5E(K)                                     NASA      721
      SUB5P(7) = SUB5P(7) + COMP5P(K)                                     NASA      722
      GO TO 300                                                           NASA      723
C                                   ** AUX PROP CER SUB-TOTAL             NASA      724
  282 SUBE(2) = SUBE(2) + COST(1,K)                                       NASA      725
      SUBT(2) = SUBT(2) + COST(2,K)                                       NASA      726
      SUBR(2) = SUBR(2) + COMPR(K)                                        NASA      727
      SUBUE(2)= SUBUE(2)+COST(4,K)                                        112574      5
      SUBUP(2)= SUBUP(2)+COST(3,K)                                        112574      6
      SUBU(2) = SUBU (2)+ COMPU(K)                                        NASA      730
      SUB5E(2) = SUB5E(2) + COMP5E(K)                                     NASA      731
      SUB5P(2) = SUB5P(2) + COMP5P(K)                                     NASA      732
      GO TO 300                                                           NASA      733
C                                   ** STRUCTURE CER SUB-TOTAL            NASA      734
  283 SUBE(6) = SUBE(6) + COST(1,K)                                       NASA      735
      SUBT(6) = SUBT(6) + COST(2,K)                                       NASA      736
      SUBR(6) = SUBR(6) + COMPR(K)                                        NASA      737
```

```
          SUBUE(6)=SUBUE(6)+ COST(4,K)                                  112574     7
          SUBUP(6)=SUBUP(6)+ COST(3,K)                                  112574     8
          SUBU(6) = SUBU(6) + COMPU(K)                                  NASA     740
          SUB5E(6) = SUB5E(6) + COMP5E(K)                               NASA     741
          SUB5P(6) = SUB5P(6) + COMP5P(K)                               NASA     742
C                                                                       NASA     743
C                                                                       NASA     744
  300 CONTINUE                                                          NASA     745
C                                                                       NASA     746
C         SUM SUB-TOTALS BY SUBSYSTEMS OF CATALOG ITEMS                 NASA     747
C                                                                       NASA     748
          IJ = 1                                                        NASA     749
          IK = 0                                                        NASA     750
          CO 320 J=1,5                                                  NASA     751
          IF (J.NE.1) IJ = IK + 1                                       NASA     752
          IK = IK + NEQUIP(J)                                           NASA     753
C                                                                       NASA     754
          DO 310 I= IJ,IK                                               NASA     755
          SUBE  (J) = SUBE  (J) + COST(1,I)                             NASA     756
          SUBT  (J) = SUBT  (J) + COST(2,I)                             NASA     757
          SUBR  (J) = SUBR  (J) + COMPR(I)                              NASA     758
          SUBUE(J) = SUBUE(J) + COST(4,I)                               112574     9
          SUBUP(J) = SUBUP(J) + COST(3,I)                               112574    10
          SUBU  (J) = SUBU  (J) + COMPU(I)                              NASA     761
          SUB5E(J) = SUB5E(J) + COMP5E(I)                               NASA     762
          SUB5P(J) = SUB5P(J) + COMP5P(I)                               NASA     763
  310 CONTINUE                                                          NASA     764
C                                                                       NASA     765
  320 CONTINUE                                                          NASA     766
          CO 9999 I = 1,7                                               NASA     767
          IF(IDEBUG.EQ.1)PRINT 9000,SUBE(I),SUBT(I),SUBR(I),SUBUE(I),   012775    16
         *                      SUBUP(I),SUBU(I),SUB5E(I),SUB5P(I)      012775    17
 9999 CONTINUE                                                          012775    18
 9000 FORMAT (8(1X,F11.0))                                              NASA     770
C                                                                       NASA     771
C    **   TOTAL COSTS FOR BASIC SPACECRAFT                              NASA     772
C                                                                       NASA     778
          DO 400 I = 1,7                                                NASA     779
          DE = DE + SUBE(I)                                             NASA     780
          TE = TE + SUBT(I)                                             NASA     781
          SYSR = SYSR + SUBR(I)                                         NASA     782
          PE = PE + SUBUE(I)                                            NASA     783
          PU = PU + SUBUP(I)                                            NASA     784
          SYSU = SYSU + SUBU(I)                                         NASA     785
          P5E = P5E + SUB5E(I)                                          NASA     786
          P5P = P5P + SUB5P(I)                                          NASA     787
  400 CONTINUE                                                          NASA     788
C                                                                       NASA     789
C         COMPUTE TOOLING AND TEST EQUIPMENT                            NASA     790
C                                                                       NASA     791
          TOOLR = 0.                                                    NASA     792
          TOOLU = 0.                                                    NASA     793
          TOOL5 = 0.                                                    NASA     794
C                                                                       NASA     795
C         COMPUTE QUALITY CONTROL                                       NASA     796
C                                                                       NASA     797
          QCR = .015*DE + .14*TE                                        NASA     798
```

```
          QCU = .015*PE + .14*PU                                             NASA      799
          QC5 = 0.015*P5E  + 0.14*P5P                                        NASA      800
C                                                                            NASA      801
C         COMPUTE SYSTEMS ENGINEERING ANC INTEGRATION                        NASA      802
C                                                                            NASA      803
          SEIR = .32*DE + .27*TE                                             NASA      804
          SEIP = .32*PE + .22*PU                                             NASA      805
          SEI5 = 0.32*P5E  +  0.22*P5P                                       NASA      806
C                                                                            NASA      807
C         COMPUTE PROGRAM MANAGEMENT                                         NASA      808
C                                                                            NASA      809
          PMR = 0.19*DE  + 0.02*TE                                           NASA      810
          PMP  = 0.19*PE  + 0.02*PU                                          NASA      811
          PM5 = 0.19*P5E  +  0.02*P5P                                        NASA      812
C                                                                            NASA      813
C   ***   TOTAL SPACE CRAFT COSTS                                            NASA      814
C                                                                            NASA      815
          SATR = SYSR + TOOLR + QCR + SEIR + PMR                             NASA      816
          SATU   = SYSU + TOOLU + QCU + SEIP + PMP                           NASA      817
C                                                                            NASA      818
C   ***   TOTAL PAYLOAC COSTS                                                NASA      819
C                                                                            NASA      820
          SATINV =NFV * SATU                                                 NASA      821
          XMEINV =NFV * XMEU                                                 NASA      822
          PAYR   = SATR + XMER                                               NASA      823
          PAYQUL =NQV * (SATU+XMEU)                                          NASA      824
          PAYINV = SATINV + XMEINV                                           NASA      825
C                                                                            NASA      826
C         CUMULATIVE AVERAGE COST FOR FIVE(5) SPACECRAFT                     NASA      827
C                                                                            NASA      828
          SAT5 = P5E + P5P + TOOL5 + QC5 + SEI5 + PM5                        NASA      829
          PRINT 9002,SAT5                                                    032475      8
 9002     FORMAT(1X,6HSAT5 =,E11.4)                                          032475      9
C                                                                            NASA      830
C   ***   COMPUTE GROUND SUPPORT EQUIPMENT COST (DEVEL. AND PROD.)           NASA      831
C                                                                            NASA      832
          IF (IMETYP.NE.1) GO TO 420                                         NASA      833
C                                             ** SET FACTOR FOR COMSAT       NASA      834
          FGSE = 0.409                                                       011675     27
          GO TO 440                                                          NASA      836
C                                                                            NASA      837
    420   IF (NCONF(5).EQ.1 .OR. NCONF(5).EQ.3 .OR. NCONF(5).EQ.5) GO TO 430 121174      5
C                                             ** SET FACTOR FOR GENERAL      NASA      840
          FGSE = 1.0                                                         NASA      841
          GO TO 440                                                          NASA      842
C                                             ** SET FACTOR FOR GENERAL PACDLE NASA    843
    430   FGSE = 2.121                                                       NASA      844
C                                                                            NASA      845
    440   GSE = 49.72* DE **.689*FGSE                                        NASA      846
C                                                                            NASA      847
C   ***   COMPUTE LAUNCH COSTS                                               NASA      848
C                                                                            NASA      849
C                                                                            NASA      850
C         COMPUTE UNIT LAUNCH COST                                           NASA      851
C                                                                            NASA      852
          XLN = 31.0 * SAT5 **0.588                                          021875      1
C                                                                            NASA      854
```

```
C *** COMPUTE TOTAL LAUNCH COSTS
C
      XLTOT = NFV * XLN
C
C
C
C
C     COMPUTE TOTALS
C
C                                                  **TOTAL DDT+E COST
      FEER = FEEPCT * (SATR + (NQV*SATU) + GSE)
      DDTE = PAYR + PAYQUL + GSE + FEER
C                                                  **TOTAL INVESTMENT COST
      FEEINV = FEEPCT * SATINV
      XVEST =  PAYINV + FEEINV
C                                                  **TOTAL OPERATIONS COST
      FEEOPS = XLTOT * FEEPCT
      OPS =  XLTOT + FEEOPS
C
      RETURN
C
      END
```

```
      SUBROUTINE PRNT (IERR,NEQUIP,NACCEP,NCONF)                        022875     3
C                                                                       NASA     878
C **  THIS IS THE OUTPUT SUBROUINE WHICH CONTROLS THE PRINTED        ** NASA     879
C **  OUTPUT OF ANY ACCEPTABLE DESIGN                                ** NASA     880
C **                                                                    NASA     881
      COMMON /USERI/   AFOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME,  022575   233
     1                 EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT,  022575   234
     2                 EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY,  022575   235
     3        IDEBUG,  ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE,  022575   236
     4         MICRO,   RELME,  SPEC(6),    SPEC1,    XDUM1,   XCGSA1,  022575   237
     5                   XMER,     XMEU                                 022575   238
      COMMON /USERP/ IPRINT,ITITLE                                      022875     4
C                                                                       022875     5
C                                                                       022575   239
      COMMON /BTWN/      ACSSN,    ACSWP,      ALT,     AREA,   BATCAP, 022575   240
     1              BITRAT(2),    CLIFE,   CONVWT,        D,       DT,  022575   241
     2                     DX,       DY,       DZ,    EQBLG,   EQBSID,  022575   242
     3                     FC,       FF,   HARNWT,      HPT,   HTPIPE,  022575   243
     4                   HTPT,   HTRFRB,   HTRPWR,             IBTLOC,  022575   244
     5                  LMBDD,       NC,    OMEGS,   PASSTR,       PJ,  022575   245
     6                     PL,    FLMIN,   POCNWT,     RADA,    RADAE,  022575   246
     7                    RAT,       RJ,   SABOLG,    SATLG,   SATTWT,  022575   247
     8                  SATWT,   SATXCG,   SATYCG,   SATZCG,    SA1XL,  022575   248
     9                  SA1YL,    SA1ZL,     SIDE,    SYSLB,   THCMWT,  022575   249
     A              THRUST(2),       TI,    TNKWT,    TPRIM,       VB,  022575   250
     B                   VCHP,      VOL,     WATE,       WB,      WBT,  022575   251
     C                     WT,       XJ,   XNZERO,       YJ,       ZJ   022575   252
C                                                                       022575   253
      COMMON /CHOSE/    COST(5,60),       DPIA(11,60),     ICHOSE(60),  022575   254
     1                  NCHOSE(60),       REL ( 6,60),     SKD(7,60),   022575   255
     2                  THM(4,60)                                       022575   256
C                                                                       022575   257
      COMMON/PRTCOM/    ACCRCY,       AM,       AN,       BF,       BS,   022575   258
     1              COPI(7,2),   CISTAR,     CTOT,     DDTE,       DE,  022575   259
     2                  ORIWT,   EQBSTR,   FEEINV,   FEEOPS,     FEER,  022575   260
     3                    GSE,     IREL,   ITRUNC,   MMDOLD,NAME(3,60), 022575   261
     4                    OPS,   PAYINV,   PAYQUL,     PAYR,       PE,  022575   262
     5                    PMP,      PMR, POWER(6),       PU,  PWR(60),  022575   263
     6                    QCP,      QCR, ROLD(60),   SABMWT,   SATADP,  022575   264
     7                 SATINV,     SATR,     SEIP,     SEIR, SKTAU(6),  022575   265
     8               SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7),  022575   266
     9                     TA, TAU(6,6),       TB,       TC,       TE,  022575   267
     A                     TF,   TOOLR,    TOOLU,   TOTOPS,    TRUNC,  022575   268
     B                     TS,        T,VOLUME(6),  VOL(60),WEIGHT(6),  022575   269
     C                 XLTOT,     XMEH,   XMEINV,     XMEL,    XMEVL,  022575   270
     D                  XMEW,    XMEWT,    XVEST                        022575   271
      DIMENSION IERR(7),NEQUIP(5),NCONF(6)                              NASA     895
      DIMENSION ITITLE(13)                                              111974    25
      REAL MMDOLD                                                       NASA     896
      MMDOLD=MMDOLD/720.                                                NASA     897
      TRUNC=TRUNC/720.                                                  NASA     898
      IF (IPRINT .EQ. 0) RETURN                                         012775    19
      IF (NACCEP.GT.1) GO TO 100                                        NASA     899
      PRINT 9000                                                        NASA     900
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 9000 FORMAT(1H1)                                                         NASA        901
 9001 FORMAT(/,1X)                                                        NASA        902
      PRINT 9002                                                          NASA        903
 9002 FORMAT(38X,41H** NASA SYSTEMS COST/PERFORMANCE STUDY **)            NASA        904
      PRINT 9001                                                          NASA        905
      PRINT 9010                                                          NASA        906
 9010 FORMAT (16H DEFINITIONS - -,/,25H    CONFIGURATIONS (NCONF),/,5X,   NASA        907
     136HSTABILIZATION AND CONTROL (NCONF(1)),15X,31HAUXILIARY PROPULSIO NASA        908
     2N (NCONF(2)),/,7X,23HNCONF(1)=1 IS DUAL SPIN,28X,22HNCONF(2)=1 IS  NASA        909
     3COLD GAS,/,7X,22HNCONF(1)=2 IS YAW SPIN,29X,28HNCONF(2)=2 IS MONOP NASA        910
     4ROPELLANT,/,7X,28HNCONF(1)=3 IS MASS EXPULSION,23X,26HNCONF(2)=3 I NASA        911
     5S BIPROPELLANT,/,7X,37HNCONF(1)=4 IS MASS EXPULSION W/ CMG-S,12X,2 NASA        912
     65HCOMMUNICATIONS (NCONF(4)),/,7X,38HNCONF(1)=5 IS MASS EXPULSION W NASA        913
     7/ M.W.-S,13X,42HNCONF(4)=1 IS SEPARATE UPLINK AND DOWNLINK,/,5X,46 NASA        914
     8HDATA PROCESSING AND INSTRUMENTATION (NCONF(3)),7X,42HNCCNF(4)=2 I 112174        1
     9S UNIFIED LINK-COMMON ANTENNAS,/,7X,39HNCONF(3)=1 IS GENERAL PURPO 112174        2
     ASE PROCESSOR,12X,44HNCONF(4)=3 IS UNIFIED LINK-SEPARATE ANTENNAS,/ 112174        3
     B,7X,39HNCONF(3)=2 IS SPECIAL PURPOSE PROCESSOR,12X,48HNCONF(4)=4 I 112174        4
     CS UNIFIED LINK-COMMON ANT + DOWNLINK,/,5X,27HELECTRICAL POWER (NCO 112174        5
     DNF(5)),26X,50HNCONF(4)=5 IS UNIFIED LINK-SEPARATE ANT + DOWNLINK,/ 112174        6
     E,7X,44HNCONF(5)=1 IS SHUNT REGULATION - PADDLE MTD.,5X,25HVEHICLE  112174        7
     FSIZING (NCONF(6)),/,7X,42HNCONF(5)=2 IS SHUNT REGULATION - BODY MT 112174        8
     GD.,9X,22HNCONF(6)=1 IS CYLINDER,/,7X,44HNCONF(5)=3 IS SHNT + DISCH 112174        9
     H.REG - PADDLE MTD.,7X,17HNCONF(6)=2 IS BOX,/,7X,42HNCONF(5)=4 IS S 112174       10
     IHNT + DISCH.REG - BODY MTD.,9X,20HNCONF(6)=3 IS SPHERE)            112174       11
      PRINT 9011                                                          NASA        926
 9011 FORMAT (7X,44HNCONF(5)=5 IS SERIES LOAD REG. - PADDLE MTD.,5X,11HR NASA        927
     1ELIABILITY,/,7X,42HNCONF(5)=6 IS SERIES LOAD REG. - BODY MTD.,9X,4 NASA        928
     25HREDUNDANCY CONFIGURATION = 0 IS SINGLE SYSTEM,/,58X,43HREDUNDANC 112174       12
     3Y CONFIGURATION = 1 IS DUAL SYSTEM)                                112174       13
C                                                                         NASA        931
      PRINT 9001                                                          NASA        932
C                                                                         NASA        933
      PRINT 9012                                                          NASA        934
 9012 FORMAT (18H    MESSAGES (IERR),/,5X,25HSTABILIZATION AND CONTROL,26 NASA        935
     1X,20HAUXILIARY PROPULSION,/,7X,29HIERR =      0 MEANS NO MESSAGES,22 NASA       936
     2X,27HIERR =   0 MEANS NC MESSAGES,/,7X,49HIERR =       1 MEANS MAX ALL NASA     937
     3OWABLE SYS. ERROR UNSAT.,2X,50HIERR =  1 MEANS CYCLE LIFE OF ATTIT NASA        938
     4UDE CONTROL     ,/,7X,42HIERR =    1X MEANS MAX RATE ERROR TOO SMALL 112174     14
     5,25X,22HTHRUSTERS IS TOO SHORT,/,7X,42HIERR =  1XX MEANS 3-AXIS WH NASA        940
     6EELS ACCEPTABLE,9X,52HIERR = 10 MEANS CYCLE LIFE OF TRANSLATIONAL  NASA        941
     7THRUSTER,/,7X,42HIERR = 1XXX MEANS DBL GIMB.CMGS ACCEPTABLE,25X,12 NASA        942
     8HIS TOO SHORT,/,5X,35HDATA PROCESSING AND INSTRUMENTATION,18X,49HI NASA        943
     9ERR = 11 MEANS CYCLE LIVES OF BOTH THRUSTERS ARE,/,7X,30HIERR =    NASA        944
     A  0 MEANS NO MESSAGES,37X,9HTOO SHORT,/,7X,31HIERR =      1 MEANS M NASA        945
     BUX REQUIRED,18X,7HTHERMAL,/,7X,41HIERR =      10 WORD LENGTH GREATER NASA      946
     C THAN 256,10X, 49HIERR = 1XXXXXXXXX MEANS BATT RAD AREA IS SUPPLIE NASA        947
     DD,/,7X,34HIERR =    100 BIT RATE IS TOO LARGE,35X,8HIN RADAB,/,7X,3 NASA       948
     E6HIERR =   1000 SPEC.COMD.SYNC.FLG NE 0,15X,  51HIERR = X1XXXXXXXX  NASA        949
     FMEANS OSR CONV. AND VARIABLE COND ,/,7X,36HIERR = 10000 END OF DAT NASA        950
     GA BASE SENSED,33X,34HUCTANCE HEAT PIPE INFO IS REQUIRED,/,5X,14HVE NASA        951
     HHICLE SIZING,39X,45HIERR = XX1XXXXXXX MEANS PHASE CONTROL MASS IS) NASA        952
C                                                                         NASA        953
      PRINT 9013                                                          NASA        954
 9013 FORMAT (7X,26HIERR = 0 MEANS NO MESSAGES,43X,15HSUPPLIED IN PCM,/, NASA        955
     17X,46HIERR = 1 MEANS BODY MOUNTED SOLAR ARRAY LENGTH,5X,50HIERR =  NASA        956
     2XXX1XXXXXX MEANS ISOTHERMALIZER IS REQUIRED,/,16X,28HEXCEEDS EQUIP NASA        957
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     3MENT BAY LENGTH,14X,51HIERR = XXXX1XXXXX MEANS DIODE HEAT PIPE IS  NASA
     4REQUIRED,/,76X,12H(2 REQUIRED),/,58X,51HIERR = XXXXX1XXXX MEANS CO NASA
     5NV. HEAT PIPE IS REQUIRED,/,58X,48HIERR = XXXXXX1XXX MEANS OSR RAD NASA
     6IATOR IS REQUIRED,/,58X,50HIERR = XXXXXXX1XX MEANS CONV. RADIATOR  NASA
     7IS REQUIRED,/,58X,48HIERR = XXXXXXXX1X MEANS HEATER POWER IS SUPPL NASA
     8IED,/,76X,9HIN HTRPWR,/,58X,49HIERR = XXXXXXXXX1 MEANS RADIATOR AR NASA
     9EA IS SUPPLIED,/,76X,7HIN RADA)                                    NASA
C                                                                        112074
C *********************************************************************  112074
C **  THIS IS THE BEGINNING OF THE SYSTEM LEVEL OUTPUT                ** 112074
C *********************************************************************  112074
C                                                                        112074
  100 PRINT 9000                                                         112074
      PRINT 9999,ITITLE                                                  112074
 9999 FORMAT (10X,13A6)                                                  112074
      FRINT 102,NACCEP                                                   112074
  102 FORMAT(47H * * * *  SYSTEM DESCRIPTION - - DESIGN NUMBER ,I3,8H *  112074
     1* * *)                                                             112074
C                                                                        112074
C     FRINT STABILIZATION AND CONTROL INFORMATION                        112074
C                                                                        112074
      FRINT 104                                                          112074
  104 FORMAT(12X,25HSTABILIZATION AND CONTROL)                           112074
C                                                                        112074
      ICONF = NCONF(1)                                                   112074
      GO TO (106,108,110,112,114),ICONF                                  112074
C                                                                        112074
C     DUAL SPIN                                                          112074
C                                                                        112074
  106 FRINT 107                                                          112074
  107 FORMAT(14X,27HCONFIGURATION - - DUAL SPIN)                         112074
      GO TO 116                                                          112074
C                                                                        112074
C     YAW SPIN                                                           112074
C                                                                        112074
  108 FRINT 109                                                          112074
  109 FORMAT(14X,26HCONFIGURATION - - YAW SPIN)                          112074
      GO TO 116                                                          112074
C                                                                        112074
C     3-AXIS MASS EXPULSION                                              112074
C                                                                        112074
  110 FRINT 111                                                          112074
  111 FORMAT(14X,43HCONFIGURATION - - THREE AXIS MASS EXPULSION)         112074
      GO TO 116                                                          112074
C                                                                        112074
C     MASS EXPULSICN WITH CONTROL MOMENT GYROS (CMG)                     112074
C                                                                        112074
  112 FRINT 113                                                          112074
  113 FORMAT(14X,58HCONFIGURATICN - - MASS EXPULSION WITH CONTROL MOMENT 112074
     1 GYROS)                                                            112074
      GO TO 116                                                          112074
C                                                                        112074
C     MASS EXPULSION WITH PITCH MOMENTUM WHEEL                           112074
C                                                                        112074
  114 PRINT 115                                                          112074
  115 FORMAT(14X,58HCONFIGURATION - - MASS EXPULSION WITH PITCH MOMENTUM 112074
     1 WHEEL)                                                            112074
```

```
C
C
  116 PRINT 117,ACCRCY
  117 FORMAT(16X,20HPOINTING ACCURACY = ,F11.6, 6H(DEG.))
C
C     PRINT AUXILIARY PROPULSION INFORMATION
C
      PRINT 119
  119 FORMAT(12X,20HAUXILIARY PROPULSION)
C
      ICONF = NCONF(2)
      GO TO (120,122,124),ICONF
C
C     COLD GAS
C
  120 PRINT 121
  121 FORMAT(14X,26HCONFIGURATION - - COLD GAS)
      GO TO 126
C
C     MONOPROPELLANT
C
  122 PRINT 123
  123 FORMAT(14X,32HCONFIGURATION - - MONOPROPELLANT)
      GO TO 126
C
C     BIPROPELLANT
C
  124 PRINT 125
  125 FORMAT(14X,30HCONFIGURATION - - BIPROPELLANT)
C
C
  126 PRINT 127,TI
  127 FORMAT(16X,16HTOTAL IMPULSE = ,F11.0, 8H(LB-SEC))
C
C     PRINT DATA PROCESSING INFORMATION
C
      PRINT 129
  129 FORMAT(12X,35HDATA PROCESSING AND INSTRUMENTATION)
C
      ICONF = NCONF(3)
      GO TO (130,132),ICONF
C
C     GENERAL PURPOSE PROCESSOR
C
  130 PRINT 131
  131 FORMAT(14X,43HCONFIGURATION - - GENERAL PURPOSE PROCESSOR)
      GO TO 134
C
C     SPECIAL PURPOSE PROCESSOR
C
  132 PRINT 133
  133 FORMAT(14X,49HCONFIGURATION - - SPECIAL PURPOSE PROCESSOR (DTU))
C
C
  134 PRINT 135,TOTOPS
  135 FORMAT(16X,27HCOMPUTER OPERATIONS RATE = ,F11.0, 5H(IPS))
C
```

```
C     PRINT CDPI INFO TABLES                                            112074
C                                                                       112074
      PRINT 136                                                         112074
  136 FORMAT(16X,10HCDPI TABLE,34X,16HENGINEERING DATA,4X,22HMISSION EQU 112074
     1IPMENT DATA)                                                      112074
      PRINT 138,CDPI(1,1),CDPI(1,2)                                     112074
  138 FORMAT(18X,18HNUMBER OF COMMANDS,35X,F5.0,18X,F5.0)               112074
      PRINT 139,CDPI(2,1),CDPI(2,2)                                     112074
  139 FORMAT(18X,26HNUMBER OF MAIN FRAME WORDS,27X,F5.0,18X,F5.0)       112074
      PRINT 140,CDPI(3,1),CDPI(3,2)                                     112074
  140 FORMAT(18X,22HMAIN FRAME SAMPLE RATE,25X,F11.0,12X,F11.0)         112074
      PRINT 141,CDPI(4,1),CDPI(4,2)                                     112074
  141 FORMAT(18X,22HMAIN FRAME WORD LENGTH,31X,F5.0,18X,F5.0)           112074
      PRINT 142,CDPI(5,1),CDPI(5,2)                                     112074
  142 FORMAT(18X,19HNUMBER OF SUBFRAMES,34X,F5.0,18X,F5.0)              112074
      PRINT 143,CDPI(6,1),CDPI(6,2)                                     112074
  143 FORMAT(18X,13HSUBFRAME RATE,38X,F11.4,12X,F11.4)                  112074
      PRINT 144,CDPI(7,1),CDPI(7,2)                                     112074
  144 FORMAT(18X,28HNUMBER OF WORDS PER SUBFRAME,25X,F5.0,18X,F5.0)     112074
C                                                                       112074
C     PRINT COMMUNICATIONS INFORMATION                                  112074
C                                                                       112074
      PRINT 146                                                         112074
  146 FORMAT(12X,14HCOMMUNICATIONS)                                     112074
C                                                                       112074
      ICONF = NCONF(4)                                                  112074
      GO TO (148,150,152,154,156),ICONF                                 112074
C                                                                       112074
C     SEPARATE UPLINK AND DOWNLINK                                      112074
C                                                                       112074
  148 PRINT 149                                                         112074
  149 FORMAT(14X,46HCONFIGURATION - - SEPARATE UPLINK AND DOWNLINK)     112074
      GO TO 158                                                         112074
C                                                                       112074
C     UNIFIED LINK - COMMON ANTENNAS                                    112074
C                                                                       112074
  150 PRINT 151                                                         112074
  151 FORMAT(14X,46HCONFIGURATION - - UNIFIED LINK-COMMON ANTENNAS)     112074
      GO TO 158                                                         112074
C                                                                       112074
C     UNIFIED LINK - SEPARATE ANTENNAS                                  112074
C                                                                       112074
  152 PRINT 153                                                         112074
      GO TO 158                                                         112074
C                                                                       112074
  153 FORMAT(14X,48HCONFIGURATION - - UNIFIED LINK-SEPARATE ANTENNAS)   112074
C     UNIFIED LINK - COMMON ANTENNAS PLUS DOWNLINK                      112074
C                                                                       112074
  154 PRINT 155                                                         112074
  155 FORMAT(14X,60HCONFIGURATION - - UNIFIED LINK-COMMON ANTENNAS PLUS 112074
     1DOWNLINK)                                                         112074
      GO TO 158                                                         112074
C     UNIFIED LINK - SEPARATE ANTENNAS PLUS DOWNLINK                    112074
C                                                                       112074
  156 PRINT 157                                                         112074
  157 FORMAT(14X,62HCONFIGURATION - - UNIFIED LINK-SEPARATE ANTENNAS PLU 112074
     1S DOWNLINK)                                                       112074
```

```
C        FRINT DATA RATES                                                       112074    165
C                                                                               112074    166
   158  PRINT 159,BITRAT(1)                                                     112074    167
   159  FORMAT(16X,30HPRIMARY DOWNLINK DATA RATE =  ,F14.3,6H(KBPS))            021975      8
C                                                                               112074    169
        PRINT 160,BITRAT(2)                                                     112074    170
   160  FORMAT(16X,30HSEPARATE DOWNLINK DATA RATE = ,F14.3,6H(KBPS))            021975      9
C                                                                               112074    172
C                                                                               112074    173
C       FRINT ELECTRICAL POWER INFORMATION                                      112074    174
C                                                                               112074    175
C                                                                               112074    176
        FRINT 162                                                               112074    177
   162  FORMAT(12X,16HELECTRICAL POWER)                                         112074    178
C                                                                               112074    179
C                                                                               112074    180
        ICONF = NCONF(5)                                                        112074    181
        GO TO (164,166,168,170,172,174),ICONF                                   112074    182
C                                                                               112074    183
C       SHUNT              - PADDLE MCUNTED                                     112074    184
C                                                                               112074    185
   164  FRINT 165                                                               112074    186
   165  FORMAT(14X,51HCONFIGURATION - - SHUNT -PADDLE MOUNTED SOLAR ARRAY)      112074    187
        GO TO 176                                                               112074    188
C                                                                               112074    189
C       SHUNT              - BODY MOUNTED                                       112074    190
C                                                                               112074    191
   166  FRINT 167                                                               112074    192
   167  FORMAT(14X,50HCONFIGURATION - - SHUNT - BODY MOUNTED SOLAR ARRAY)       112074    193
        GO TO 176                                                               112074    194
C                                                                               112074    195
C       SHUNT AND DISCHARGE - PADDLE MOUNTED                                    112074    196
C                                                                               112074    197
   168  FRINT 169                                                               112074    198
   169  FORMAT(14X,77HCONFIGURATION - - SHUNT AND DISCHARGE REGULATION - P      112074    199
       1ADDLE MOUNTED SOLAR ARRAY)                                              112074    200
        GO TO 176                                                               112074    201
C                                                                               112074    202
C       SHUNT AND DISCHARGE - BODY MOUNTED                                      112074    203
C                                                                               112074    204
   170  FRINT 171                                                               112074    205
   171  FORMAT(14X,75HCONFIGURATION - - SHUNT AND DISCHARGE REGULATION - B      112074    206
       1ODY MOUNTED SOLAR ARRAY)                                                112074    207
        GO TO 176                                                               112074    208
C                                                                               112074    209
C       SERIES LOAD REGULATION - PADDLE MOUNTED                                 112074    210
C                                                                               112074    211
   172  FRINT 173                                                               112074    212
   173  FORMAT(14X,69HCONFIGURATION - - SERIES LOAD REGULATION - PADDLE MO      112074    213
       1UNTED SOLAR ARRAY)                                                      112074    214
        GO TO 176                                                               112074    215
C                                                                               112074    216
C       SERIES LOAD REGULATION - BODY MOUNTED                                   112074    217
C                                                                               112074    218
   174  FRINT 175                                                               112074    219
   175  FORMAT(14X,67HCONFIGURATICN - - SERIES LOAD REGULATION - BODY MOUN      112074    220
       1TED SOLAR ARRAY)                                                        112074    221
```

```
C                                                                              112074
C     PRINT E.P. STATS                                                         112074
C                                                                              112074
  176 PRINT 177,PL                                                             112074
  177 FORMAT(16X,35HEND OF LIFE POWER REQUIREMENT     =,F11.2,7H(WATTS))      112074
C                                                                              112074
      PRINT 179,AREA                                                           112074
  179 FORMAT(16X,22HTOTAL SOLAR ARRAY AREA,12X,1H=,F11.2, 7H(FT**2))         112074
C                                                                              112074
      PRINT 181,CISTAR                                                         112074
  181 FORMAT(16X,35HMINIMUM INSTALLED BATTERY CAPACITY=,F11.2,8H(AMP-HR)     112074
     1)                                                                        112074
C                                                                              112074
C     PRINT VEHICLE SIZING INFORMATION                                         112074
C                                                                              112074
      PRINT 183                                                                112074
  183 FORMAT(12X,14HVEHICLE SIZING)                                            112074
C                                                                              112074
C                                                                              112074
      ICONF = NCONF(6)                                                         112074
      GO TO (184,186,188),ICONF                                                112074
C                                                                              112074
C     CYLINDER                                                                 112074
C                                                                              112074
  184 PRINT 185                                                                112074
  185 FORMAT(14X,26HCONFIGURATION - - CYLINDER)                                112074
      GO TO 190                                                                112074
C                                                                              112074
C     BOX                                                                      112074
C                                                                              112074
  186 PRINT 187                                                                112074
  187 FORMAT(14X,21HCONFIGURATION - - BOX)                                     112074
      GO TO 190                                                                112074
C                                                                              112074
C     SPHERE                                                                   112074
C                                                                              112074
  188 PRINT 189                                                                112074
  189 FORMAT(14X,24HCONFIGURATION - - SPHERE)                                  112074
C                                                                              112074
C     PRINT VEHICLE WEIGHT AND LAUNCH WEIGHT                                   112074
C                                                                              112074
  190 PRINT 191,SATWT,SATTWT                                                   112074
  191 FORMAT(16X,17HVEHICLE WEIGHT = ,F11.2,23H(LBS)  LAUNCH WEIGHT = ,       112074
     *F11.2,5H(LBS))                                                           112074
C                                                                              112074
C                                                                              112074
C     PRINT EQUIPMENT BAY DIMENSIONS                                           112074
C                                                                              112074
      PRINT 192,EQBLG,SIDE,SIDE                                                112074
  192 FORMAT(16X,31HEQUIPMENT BAY DIMENSIONS LENGTH,F11.2,11H(IN),HEIGHT      112074
     1,F11.2,10H(IN),WIDTH,F11.2,4H(IN))                                       112074
C                                                                              112074
C     PRINT MAXIMUM MISSION EQUIPMENT HEIGHT AND WIDTHAND LENGTH               112074
C                                                                              112074
      PRINT 193,XMEL,XMEH,XMEW                                                 112074
  193 FORMAT(16X,25HMISSION EQUIPMENT LENGTH ,F11.2,12H(IN),HEIGHT ,F11.      112074
     12,12H(IN), WIDTH ,F11.2,4H(IN))                                          112074
```

```
C
C     PRINT TOTAL SATELLITE LENGTH
C
      PRINT 194,SATLG
  194 FORMAT(16X,23HTOTAL SATELLITE LENGTH ,F11.2,4H(IN))
C
C     PRINT MOMENTS OF INERTIA
C
      PRINT 195,XJ,YJ,ZJ
  195 FORMAT(16X,33HMOMENTS OF INERTIA(LB-IN**2) IXX=,F11.1, 5H IYY=,F11
     1.1,5H IZZ=,F11.1)
      PRINT 9000
C
C     PRINT SAFETY(RELIABILITY) INFORMATION
C
C
      PRINT 200
  200 FORMAT(12X, 6HSAFETY)
C
      ICONF = IREL + 1
      GO TO(202,204),ICONF
C
C     SINGLE SYSTEM
C
  202 PRINT 203
  203 FORMAT(14X,31HCONFIGURATION - - SINGLE SYSTEM)
      GO TO 206
C
C     DUAL SYSTEM
C
  204 PRINT 205
  205 FORMAT(14X,29HCONFIGURATION - - DUAL SYSTEM)
C
C     PRINT REL STATS
C
  206 PRINT 207,MMDOLD
  207 FORMAT(16X,21HMEAN MISSION DURATION,7X,F11.1,4H(MO))
C
      PRINT 209,ROLD(ITRUNC)
  209 FORMAT(16X,11HRELIABILITY,17X,F11.3)
C
      PRINT 211,TRUNC
  211 FORMAT(16X,28HMISSION LIFETIME            ,F11.1,4H(MO))
C
C
C     BEGIN COST PRINT-OUTS
C
C
      PRINT 220
  220 FORMAT(12X,34HCOSTS (ALL AMOUNTS ARE IN DOLLARS))
C
      PRINT 222
  222 FORMAT(55X, 5HDDT+E,28X,22HINVESTMENT (RECURRING))
C
C     PRINT DES. ENG.(DE) AND UNIT ENG.(PE)
C
      PRINT 224,DE,PE
```

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  224 FORMAT(16X,18HDESIGN ENGINEERING,18X,F13.1,4X,16HUNIT ENGINEERING,  112074   336
     111X,F11.1)                                                          112074   337
C                                                                         112074   338
C       PRINT TEST AND EVAL.(TE) AND UNIT PROD. (PU)                      112074   339
C                                                                         112074   340
      PRINT 226,TE,PU                                                     112074   341
  226 FORMAT(16X,19HTEST AND EVALUATION,17X,F13.1,4X,15HUNIT PRODUCTION,  112074   342
     112X,F11.1)                                                          112074   343
C                                                                         112074   344
C      PRINT TOOLING (TOOLR + TOOLU)                                      112074   345
C                                                                         112074   346
      PRINT 228,TOOLR,TOOLU                                               112074   347
  228 FORMAT(16X,26HTOOLING AND TEST EQUIPMENT,10X,F13.1,4X,24HTOOLING A  112074   348
     1ND TEST EQUIP. ,1X,F13.1)                                           112074   349
C                                                                         112074   350
C       PRINT QUALITY CONTROL (QCR + QCP)                                 112074   351
C                                                                         112074   352
      PRINT 230,QCR,QCP                                                   112074   353
  230 FORMAT(16X,15HQUALITY CONTROL,21X,F13.1,4X,15HQUALITY CONTROL,10X,  112074   354
     1F13.1)                                                              112074   355
C                                                                         112074   356
C       PRINT SYSTEM ENG.AND INTEGRATION (SEIR + SEIP)                    112074   357
C                                                                         112074   358
      PRINT 232,SEIR,SEIP                                                 112074   359
  232 FORMAT(16X,36HSYSTEMS ENGINEERING AND INTEGRATION ,F13.1,4X,21HSYS  112074   360
     1TEMS ENG. AND INT.,4X,F13.1)                                        112074   361
C                                                                         112074   362
C      PRINT PROGRAM MANAGEMENT (PMR + PMP)                               112074   363
C                                                                         112074   364
      PRINT 234,PMR,PMP                                                   112074   365
  234 FORMAT(16X,18HPROGRAM MANAGEMENT,18X,F13.1,4X,18HPROGRAM MANAGEMEN  112074   366
     1T,7X,F13.1)                                                         112074   367
C                                                                         112074   368
C                                                                         112074   369
C       PRINT COSTS BY DDT+E,INVESTMENT AND OPERATIONS BREAK-OUT          112074   370
C                                                                         112074   371
C                                                                         112074   372
      PRINT 236                                                           112074   373
  236 FORMAT(14X,13HCOST CATEGORY,13X,5HDDT+E,15X,10HINVESTMENT,15X,      112074   374
     *  10HOPERATIONS)                                                    112074   375
C                                                                         112074   376
C       PRINT SPACECRAFT COSTS                                            112074   377
C                                                                         112074   378
      PRINT 238,SATR,SATINV                                               112074   379
  238 FORMAT(16X,10HSPACECRAFT,10X,F13.1,9X,F13.1)                        112074   380
C                                                                         112074   381
C       PRINT MISSION EQUIPMENT COSTS                                     112074   382
C                                                                         112074   383
      PRINT 240,XMER,XMEINV                                               022675     7
  240 FORMAT(16X,17HMISSION EQUIPMENT,3X,F13.1,9X,F13.1)                  112074   385
C                                                                         112074   386
C       PRINT TOTAL PAYLOAD COSTS (SUM OF PRECEDING TWO)                  112074   387
C                                                                         112074   388
      PRINT 242,PAYR,PAYINV                                               112074   389
  242 FORMAT(16X,13HTOTAL PAYLOAD,7X,F13.1,9X,F13.1)                      112074   390
C                                                                         112074   391
C       PRINT QUALIFICATION UNITS COST                                    112074   392
```

```
C
      PRINT 244,PAYQLL
  244 FORMAT(16X,20HQUALIFICATION UNITS ,F13.1)
C
C     PRINT GSE
C
      PRINT 246,GSE
  246 FORMAT(16X, 6HG.S.E.,14X,F13.1)
C
C     PRINT LAUNCH SUPPORT
C
      PRINT 248,XLTOT
  248 FORMAT(16X,14HLAUNCH SUPPORT,53X,F13.1)
C
C     PRINT CONTRACTOR FEE
C
      PRINT 250,FEER,FEEINV,FEEOPS
  250 FORMAT(16X,14HCONTRACTOR FEE,6X,F13.1,9X,F13.1,12X,F13.1)
C
C     PRINT PROGRAM TOTALS
C
      PRINT 252,DDTE,XVEST,OPS
  252 FORMAT(16X,14HPROGRAM TOTALS,6X,F13.1,9X,F13.1,12X,F13.1)
C
C
C     PRINT SCHEDULE INFORMATION
C
C
      PRINT 254
  254 FORMAT(12X, 8HSCHEDULE)
C
C     PRINT COMPONENT DESIGN DEVELOPMENT TIME
C
      PRINT 256,SKTAU(1)
  256 FORMAT(16X,33HCOMPONENT DESIGN DEVELOPMENT TIME,13X,F5.1,8H(MONTHS
     1))
C
C     PRINT COMPONENT QUALIFICATION TIME
C
      PRINT 258,SKTAU(2)
  258 FORMAT(16X,28HCOMPONENT QUALIFICATION TIME,18X,F5.1,8H(MONTHS))
C
C     PRINT SUBSYSTEM DEVELOPMENT TIME
C
      PRINT 260,SKTAU(3)
  260 FORMAT(16X,26HSUBSYSTEM DEVELOPMENT TIME,20X,F5.1,8H(MONTHS))
C
C     PRINT SUBSYSTEM QUALIFICATION TIME
C
      PRINT 262,SKTAU(4)
  262 FORMAT(16X,28HSUBSYSTEM QUALIFICATION TIME,18X,F5.1,8H(MONTHS))
C
C     PRINT SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME
C
      PRINT 264,SKTAU(5)
  264 FORMAT(16X,46HSYSTEM DEVELOPMENT AND FLIGHT READINESS TIME  ,F5.1,
     18H(MONTHS))
```

```
C                                                                        112074   450
C        FRINT SCHEDULE DURATION TO LAUNCH                               112074   451
C                                                                        112074   452
         FRINT 266,SKTAU(6)                                              112074   453
  266 FORMAT(16X,29HSCHEDULE DURATION (TO LAUNCH),17X,F5.1,8H(MONTHS))   112074   454
C                                                                        112074   455
C ********************************************************************** 112074   456
C **      END OF SYSTEM PRINT-OUT --- BEGIN SUBSYSTEM IF REQUIRED     ** 112074   457
C ********************************************************************** 112074   458
C                                                                        112074   459
         FRINT 9000                                                      112074   460
         IF (IPRINT.LE.1) RETURN                                         112074   461
         FRINT 9999,ITITLE                                               112074   462
         FRINT 1000,NACCEP                                               112074   463
 1000 FORMAT(51H * * * *  SUBSYSTEM DESCRIPTIONS - - DESIGN NUMBER ,I3,8 112074   464
     1H * * * *)                                                         112074   465
         FRINT 104                                                       112074   466
         ICONF = NCONF(1)                                                112074   467
         GO TO (1004,1006,1008,1010,1012),ICONF                          112074   468
C        DUAL SPIN                                                       112074   469
 1004 FRINT 107                                                          112074   470
         GO TO 1014                                                      112074   471
C        YAW SPIN                                                        112074   472
 1006 FRINT 109                                                          112074   473
         GO TO 1014                                                      112074   474
C        3-AXIS MASS EXPULSION                                           112074   475
 1008 FRINT 111                                                          112074   476
         GO TO 1014                                                      112074   477
C        M.E. W/ CMG                                                     112074   478
 1010 FRINT 113                                                          112074   479
         GO TO 1014                                                      112074   480
C        M.E. W/ P.M.W.                                                  112074   481
 1012 FRINT 115                                                          112074   482
C                                                                        112074   483
C                                                                        112074   484
C                                                                        112074   485
 1014 CONTINUE                                                           112074   486
C                                                                        112074   487
C        FRINT S + C EQUIPMENT IDENTIFIERS                               112074   488
C                                                                        112074   489
         IK = NEQUIP(1)                                                  112074   490
C                                                                        112074   491
         FRINT 1020,(ICHOSE(I),I=1,IK)                                   112074   492
 1020 FORMAT(14X,25HEQUIPMENT CODE IDENTIFIER,14(1X,I4))                 112074   493
         FRINT 1022,(NCHOSE(I),I=1,IK)                                   112074   494
 1022 FORMAT(14X,25HEQUIPMENT QUANTITIES      ,14(1X,I4))                112074   495
         PRINT 1024,WEIGHT(1),VOLUME(1),POWER(1)                         112074   496
 1024 FORMAT(24X,7HWEIGHT ,F11.2,13H(LB), VOLUME ,F11.2,27H(FT**3), POWE 112074   497
     1R REQUIREMENT ,F11.1,6H(WATT))                                     120474    12
C                                                                        112074   499
C        FRINT S+C COSTS                                                 112074   500
C                                                                        112074   501
         FRINT 1026,SUBE(1),SUBT(1),SUBUP(1),SUBUE(1)                    112074   502
 1026 FORMAT(24X,16HDES. ENG. COST  ,F11.1,10X,17HTEST + EVAL. COST,4X,F 112074   503
     *11.1,/,24X,16HUNIT PROD.COST  ,F11.1,10X,17HUNIT ENG.    COST,4X,F 112074   504
     *11.1)                                                              112074   505
C                                                                        112074   506
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C      PRINT S+C REL
C
       FRINT 1028,SSREL(1)
 1028  FORMAT(24X,11HRELIABILITY,5X,F11.4)
C
C      FRINT S+C SCHEDULE
C
C      FRINT S+C SCHEDULE
C
       FRINT 1030,(TAU(1,J),J=1,5)
 1030  FORMAT(24X, 8HSCHEDULE,/,26X,27HCOMPONENT DEVELOPMENT TIME ,F5.1,3
      *7H(MONTH) COMPONENT QUALIFICATION TIME ,F5.1,7H(MONTH),/,26X,27HSU
      *BSYSTEM DEVELOPMENT TIME ,F5.1,37H(MONTH) SUBSYSTEM QUALIFICATION
      *TIME ,F5.1,7H(MONTH),/,26X,45HSYSTEM DEVELOPMENT AND FLIGHT READIN
      *ESS TIME ,F5.1,7H(MONTH))
       FRINT 1032,IERR(1)
 1032  FORMAT(24X,4HIERR,5X,I10)
C      PRINT A.P. SUBSYSTEM INFO
C
C
       FRINT 119
C
       ICONF = NCONF(2)
       GO TO (1034,1036,1038),ICONF
C
C      COLD GAS
C
 1034  FRINT 121
       GO TO 1040
C
C      MONOPROPELLANT
C
 1036  FRINT 123
       GO TO 1040
C
C      BIPROPELLANT
C
 1038  FRINT 125
C
C
 1040  IJ = IK + 1
       IK = NEQUIP(2) + IK
C
       FRINT 1020,(ICHOSE(I),I=IJ,IK)
       FRINT 1022,(NCHOSE(I),I=IJ,IK)
       FRINT 1024,WEIGHT(2),VOLUME(2),POWER(2)
       FRINT 1041,DRIWT,ACSWP
 1041  FORMAT(24X,11HDRY WEIGHT F11.2,25H(LBS), EXPENDABLE WEIGHT ,F11.2,
      15H(LBS))
       FRINT 1026,SUBE(2),SUBT(2),SUBUP(2),SUBUE(2)
       FRINT 1028,SSREL(2)
       PRINT 1030,(TAU(2,J),J=1,5)
       FRINT 1032,IERR(2)
C
C      FRINT OPI S/S INFO
C
C
```

```
      FRINT 129
C
      ICONF = NCONF(3)
      GO TO (1042,1044),ICONF
C
C     GEN. PURP. PROC.
C
 1042 FRINT 131
      GO TO 1046
C
C     SPEC. PURP. FROC.
C
 1044 PRINT 133
C
 1046 IJ = IK + 1
      IK = NEQUIP(3) + IK
C
      FRINT 1020,(ICHOSE(I),I=IJ,IK)
      PRINT 1022,(NCHOSE(I),I=IJ,IK)
      FRINT 1024,WEIGHT(3),VOLUME(3),POWER(3)
      FRINT 1026,SUBE(3),SUBT(3),SUBUP(3),SUBUE(3)
      FRINT 1028,SSREL(3)
      PRINT 1030,(TAU(3,J),J=1,5)
      FRINT 1032,IERR(3)
C
C     FRINT COMM S/S INFO
C
C
      FRINT 9000
      FRINT 146
C
      ICONF = NCONF(4)
      GO TO (1048,1050,1052,1054,1056),ICONF
C     SEPARATE UP + DOWN
 1048 FRINT 149
      GO TO 1058
C     UNIF. COM. ANT.
 1050 PRINT 151
      GO TO 1058
C     UNIF. SEP. ANT.
 1052 FRINT 153
      GO TO 1058
C     UNIF. COM. ANT. + DOWN
 1054 FRINT 155
      GO TO 1058
C     UNIF. SEP. ANT. + DOWN
 1056 FRINT 157
C
C
C
 1058 IJ = IK + 1
      IK = NEQUIP(4) + IK
C
      FRINT 1020,(ICHOSE(I),I=IJ,IK)
      PRINT 1022,(NCHOSE(I),I=IJ,IK)
      FRINT 1024,WEIGHT(4),VOLUME(4),POWER(4)
      PRINT 1026,SUBE(4),SUBT(4),SUBUP(4),SUBUE(4)
```

```
      PRINT 1028,SSREL(4)                                                112074  621
      PRINT 1030,(TAU(4,J),J=1,5)                                         112074  622
      FRINT 1032,IERR(4)                                                  032675    1
C                                                                         112074  623
C     FRINT E.P. S/S INFO.                                                112074  624
C                                                                         112074  625
      PRINT 162                                                           112074  626
C                                                                         112074  627
      ICONF = NCONF(5)                                                    112074  628
      GO TO (1060,1062,1064,1066,1068,1070),ICONF                         112074  629
C                                                                         112074  630
C     SHNT / PADDLE                                                       112074  631
 1060 FRINT 165                                                           112074  632
      GO TO 1072                                                          112074  633
C                                                                         112074  634
C     SHNT / BODY                                                         112074  635
 1062 FRINT 167                                                           112074  636
      GO TO 1072                                                          112074  637
C                                                                         112074  638
C     SHNT + DSCHG  / PADDLE                                              112074  639
 1064 FRINT 169                                                           112074  640
      GO TO 1072                                                          112074  641
C                                                                         112074  642
C     SHNT + DSCHG  / BODY                                                112074  643
 1066 FRINT 171                                                           112074  644
      GO TO 1072                                                          112074  645
C                                                                         112074  646
C     SER. LD. / PADDLE                                                   112074  647
 1068 FRINT 173                                                           112074  648
      GO TO 1072                                                          112074  649
C                                                                         112074  650
C     SER. LD. / BODY                                                     112074  651
 1070 FRINT 175                                                           112074  652
C                                                                         112074  653
C                                                                         112074  654
 1072 IJ = IK + 1                                                         112074  655
      IK = NEQUIP(5) + IK                                                 112074  656
C                                                                         112074  657
      PRINT 1020,(ICHOSE(I),I=IJ,IK)                                      112074  658
      FRINT 1022,(NCHOSE(I),I=IJ,IK)                                      112074  659
      FRINT 1024,WEIGHT(5),VOLUME(5),POWER(5)                             112074  660
      FRINT 1074,HARNWT,WATE                                              112074  661
      PRINT 1026,SUBE(5),SUBT(5),SUBUP(5),SUBUE(5)                        112074  662
      FRINT 1028,SSREL(5)                                                 112074  663
      FRINT 1030,(TAU(5,J),J=1,5)                                         112074  664
 1074 FORMAT(24X,14HHARNESS WEIGHT,F11.1,25H(LBS), SOLAR ARRAY WEIGHT,F1  112074  665
     *1.1,5H(LBS))                                                        112074  666
C                                                                         112074  667
C     FRINT MISSION EQUIPMENT INFORMATION                                 112074  668
C                                                                         112074  669
      FRINT 1076                                                          112074  670
 1076 FORMAT(12X,17HMISSION EQUIPMENT)                                    112074  671
      PRINT 1024,XMEWT,XMEVL,EPME                                         112074  672
      FRINT 1078,XMER,XMEU                                                112074  673
 1078 FORMAT(24X,10HDDT+E COST,6X,F11.1,9X,17HAVERAGE UNIT COST,3X,F11.1  112074  674
     *)                                                                   112074  675
      FRINT 1028,SSREL(6)                                                 112074  676
```

```
      PRINT 1030,(TAU(6,J),J=1,5)                                       112074
      PRINT 9000                                                        112074
C                                                                       112074
C     PRINT THERMAL CONTROL SUBSYSTEM INFORMATION                       112074
C                                                                       112074
      PRINT 1080                                                        112074
 1080 FORMAT(12X,15HTHERMAL CONTROL)                                    112074
      PRINT 1082,RADA,RADAB,RAT                                         112074
 1082 FORMAT(14X,13HRADIATOR AREA,3X,F11.1,32H (FT**2),   BATTERY RADIATO 112074
     *R AREA,7X,F11.1,8H (FT**2),/,52X,19HTOTAL RADIATOR AREA,9X,F11.1, 112074
     *8H (FT**2))                                                       112074
      PRINT 1084,HTRPWR,HTRPRB,HPT                                      112074
 1084 FORMAT(14X,12HHEATER POWER,4X,F11.1,31H(BTU/HR),   BATTERY HEATER P 112074
     *OWER,8X,F11.1,8H(BTU/HR),/,52X,18HTOTAL HEATER POWER,10X,F11.1,8H( 112074
     *BTU/HR))                                                          112074
      PRINT 1086,HTPIPE,VCHP                                            112074
 1086 FORMAT(14X,10HHEAT PIPE ,6X,F11.1,39H(WATT-IN), VARIABLE CONDUCTAN 112074
     *CE H.P.    ,F11.1,9H(WATT-IN))                                    112074
      PRINT 1088,THCMWT                                                 112074
 1088 FORMAT(14X,23HTHERMAL CONTROL WEIGHT ,F11.1,5H(LBS))              112074
      PRINT 1026,SUBE(7),SUBT(7),SUBUP(7),SUBUE(7)                      112074
      PRINT 1032,IERR(7)                                                112074
C                                                                       112074
C     PRINT STRUCTURES SUBSYSTEM INFORMATION                            112074
C                                                                       112074
      PRINT 1090                                                        112074
 1090 FORMAT(12X,10HSTRUCTURES)                                         112074
      PRINT 1092,T                                                      112074
 1092 FORMAT(14X,16HSKIN THICKNESS  ,F11.3,5H (IN))                     112074
      PRINT 1094,AN,TS,BS                                               112074
 1094 FORMAT(14X,26HSTRINGER NO.,THICKNESS,HT.,8X,F5.0,5X,1H,,8X,F11.3,6 112074
     *H (IN),,5X,F11.3,5H (IN))                                         112074
      PRINT 1096,AM,TF,BF                                               112074
 1096 FORMAT(14X,26HFRAME    NO.,THICKNESS,HT.,8X,F5.0,5X,1H,,8X,F11.3,6 112074
     *H (IN),,5X,F11.3,5H (IN))                                         112074
      PRINT 1098,TC,TB,TA                                               112074
 1098 FORMAT(14X,28HENDCOVER THICKNESS- FORWARD ,F11.3,14H (IN), CENTER  112074
     *,F11.3,11H (IN), AFT ,F11.3,5H (IN))                              112074
      PRINT 1100,EQBSTR,SABMWT,SATADP                                   112074
 1100 FORMAT(14X,27HEQUIPMENT BAY STRUCTURE WT.,3X,F11.1,6H (LBS),/,    112074
     *          14X,30HSOLAR ARRAY BOOM AND DRIVE WT.,F11.1,6H (LBS),/, 112074
     *          14X,14HADAPTER WEIGHT,16X,F11.1,6H (LBS))               112074
      PRINT 1026,SUBE(6),SUBT(6),SUBUP(6),SUBUE(6)                      112074
C                                                                       112074
C ********************************************************************* 112074
C **      END OF SUBSYSTEM PRINT - BEGIN ASSEMBLY LEVEL (IF REQUIRED) ** 112074
C ********************************************************************* 112074
C                                                                       112074
      PRINT 9000                                                        112074
      IF (IPRINT.LE.2) RETURN                                           112074
C                                                                       112074
      PRINT 9999,ITITLE                                                 112074
      PRINT 2000,NACCEP                                                 112074
 2000 FORMAT(50H * * * *  ASSEMBLY DESCRIPTIONS - - DESIGN NUMBER ,I3,8H 112074
     * * * * *)                                                         112074
      PRINT 104                                                         112074
C                                                                       112074
```

```
      PRINT 2010
 2010 FORMAT(39X,4HUNIT,3X,4HUNIT,3X,4HUNIT,29X,7HVEHICLE,7X,7HVEHICLE,/ 112074     734
     *,11X,96HIDENT  TYPE                 NO. WEIGHT VOLUME POWER  D.E. COST 121274       1
     *  T.E. COST    PROD. COST       ENG COST)                             121274       2
      IJ = 1                                                              121274       3
      IK = NEQUIP(1)                                                      112074     738
C     PRINT S+C                                                           112074     739
      DO 2100 I = IJ,IK                                                   112074     740
 2100 PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VQL(I),   112074     741
     1             PWR(I),(COST(J,I),J=1,4)                               112074     742
 2110 FORMAT(11X,I4,1X,3A6,1X,I3,1X,F6.1,1X,F5.1,1X,F6.1,F11.1,1X,F11.1,  112074     743
     11X,F11.1,1X,F11.1)                                                  112074     744
C                                                                         112074     745
C     PRINT A.P.                                                          112074     746
      IJ = IK + 1                                                         112074     747
      IK = NEQUIP(2) + IK                                                 112074     748
C                                                                         112074     749
      PRINT 9001                                                          112074     750
      PRINT 119                                                           112074     751
C                                                                         112074     752
      PRINT 2010                                                          112074     753
      DO 2200 I = IJ,IK                                                   112074     754
 2200 PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VQL(I),   112074     755
     1             PWR(I),(COST(J,I),J=1,4)                               112074     756
C     PRINT DPI                                                           112074     757
C                                                                         112074     758
      IJ = IK+1                                                           112074     759
      IK = NEQUIP(3) + IK                                                 112074     760
C                                                                         112074     761
      PRINT 9001                                                          112074     762
      PRINT 129                                                           112074     763
C                                                                         112074     764
      PRINT 2010                                                          112074     765
      DO 2300 I = IJ,IK                                                   112074     766
 2300 PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VQL(I),   112074     767
     1             PWR(I),(COST(J,I),J=1,4)                               112074     768
C                                                                         112074     769
C     PRINT COMM                                                          112074     770
C                                                                         112074     771
      IJ = IK + 1                                                         112074     772
      IK = NEQUIP(4) + IK                                                 112074     773
C                                                                         112074     774
      PRINT 9001                                                          112074     775
      PRINT 146                                                           112074     776
C                                                                         112074     777
      PRINT 2010                                                          112074     778
      DO 2400 I = IJ,IK                                                   112074     779
 2400 PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VQL(I),   112074     780
     1             PWR(I),((COST(J,I),J=1,4)                              112074     781
C                                                                         112074     782
C     PRINT E.P.                                                          112074     783
C                                                                         112074     784
      IJ = IK + 1                                                         112074     785
      IK = NEQUIP(5) + IK                                                 112074     786
C                                                                         112074     787
      PRINT 9000                                                          112074     788
      PRINT 162                                                           112074     789
                                                                          112074     790
```

```
C                                                                          112074     791
      PRINT 2010                                                           112074     792
      DO 2500 I=IJ,IK                                                      112074     793
      ICHS = ICHOSE(I)/100                                                 112574      14
      IF (ICHS.EQ.2) REL(1,I) = WB                                         112574      15
      IF (ICHS.EQ.2) VOL(I) = VB                                           112574      16
2500  PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VOL(I),    112074     794
     1           PWR(I),(COST(J,I),J=1,4)                                  112074     795
      PRINT 9001                                                           112574      17
      PRINT 2600                                                           112574      18
 2600 FORMAT(10X,46HEQUIPMENTS USING COST ESTIMATING RELATIONSHIPS)        112574      19
      PRINT 2610                                                           112574      20
 2610 FORMAT(88X,7HVEHICLE,7X,7HVEHICLE,/,12X,4HNAME,21X,6HWEIGHT,17X,48   121274       4
     *HD.E. COST    T.E. COST     PROD. COST     ENG. COST)                121274       5
C                                                                          112574      23
      I  = IK + 1                                                          112574      24
C                                                                          112574      25
      PRINT 2620,WATE,(COST(J,I),J=1,4)                                    112574      26
 2620 FORMAT(12X,11HSOLAR ARRAY,9X,F11.1,16X,2(F11.1,1X),1X,2(F11.1,2X))   112574      27
C                                                                          112574      28
      I = I + 1                                                            112574      29
C                                                                          112574      30
      PRINT 2630,HARNWT,(COST(J,I),J=1,4)                                  112574      31
 2630 FORMAT(12X,14HHARNESS           ,6X,F11.1,16X,2(F11.1,1X),1X,2(F11.1,2 112574      32
     *X))                                                                  112574      33
C                                                                          112574      34
      I = I  + 1                                                           112574      35
      PRINT 2640,THCMWT,(COST(J,I),J=1,4)                                  112574      36
 2640 FORMAT(12X,20HTHERMAL CONTROL       ,F11.1,16X,2(F11.1,1X),1X,2(F11. 112574      37
     *1,2X))                                                               112574      38
C                                                                          112574      39
      I = I + 1                                                            112574      40
C                                                                          112574      41
      PRINT 2650,CONVWT,(COST(J,I),J=1,4)                                  112574      42
 2650 FORMAT(12X,16HPOWER CONVERTERS,4X,F11.1,16X,2(F11.1,1X),1X,2(F11.1   112574      43
     M,2X))                                                                112574      44
C                                                                          112574      45
      I = I + 1                                                            112574      46
C                                                                          112574      47
      PRINT 2660,(COST(J,I),J=1,4)                                         112574      48
 2660 FORMAT(12X,20HPROPULSION FEED SYS.,       27X,2(F11.1,1X),1X,2(F11.  112574      49
     *1,2X))                                                               112574      50
C                                                                          112574      51
      I = I + 1                                                            112574      52
C                                                                          112574      53
      PRINT 2670,PASSTR,(COST(J,I),J=1,4)                                  112574      54
 2670 FORMAT(12X,20HSTRUCTURE                ,F11.1,16X,2(F11.1,1X),1X,2(F11. 112574   55
     *1,2X))                                                               112574      56
C                                                                          112574      57
      I = I + 1                                                            112574      58
C                                                                          112574      59
      PRINT 2680, POCNWT,(COST(J,I),J=1,4)                                 112574      60
 2680 FORMAT(12X,20HPOWER CONTROL UNITS ,F11.1,16X,2(F11.1,1X),1X,2(F11.   112574      61
     *1,2X))                                                               112574      62
C                                                                          112074     796
      PRINT 9000                                                           112074     797
C ******************************************************************       112074     798
```

```
C **       END-OF-PRINT ROUTINE                                              ** 112074
C ***************************************************************************** 112074
C                                                                                112074
  970    RETURN                                                                  112074
C                                                                                112074
         END                                                                     112074
```

```
      SUBROUTINE FILTER(NCONF,ICODE)                                     NASA      1138
C      FILTER CHECKS FOR COMPATIBLE COMBINATIONS OF CONFIGURATIONS       NASA      1139
C      A MINUS 1 IS RETURNED FOR UNACCEPTABLE COMBINATIONS               NASA      1140
C      NCONF IS ARRAY OF CONFIGURATIONS                                  NASA      1141
C      ICODE IS CODE RETURNED                                            NASA      1142
      DIMENSION NCONF(6)                                                 NASA      1143
      COMMON /USER1/     ALPHA,       AX,       AY,       AZ,     DPHI,  022575     272
     1                      EA,     EANT,      EP1,        K,     MANV,  022575     273
     2                   OMEGR,   PDOTAV,   PDOTRX,   PDOTRY,   PDOTRZ,  022575     274
     3                  PDOTST,    PDOTX,    PDOTY,    PDOTZ,    PDOTO,  022575     275
     4                  PHIFOV,    PHIRX,    PHIRY,    PHIRZ,   TACCEL,  022575     276
     5                  THETMX,    THOLD,       TL,    TPMIN,   TSMALL,  022575     277
     6                      XN,      XNN,     XNNN,      XNU,       YN,  022575     278
     7                      ZN                                           022575     279
C                                                                        022575     280
      COMMON /USER3/ARRAYN(11,3), BTRMX,    NMSEQ,    OPSMS,    SCSFL,  022575     281
     1                   TPRFL                                           022575     282
C                                                                        022575     283
      COMMON /USER4/BWIDTH(2),  FREQ(2),    FREQR,   IOPTCM,     LINK,   032475      10
     1                   NADIR,      NET                                 022575     285
C                                                                        022575     286
      COMMON /USERI/    APOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME,  022575     287
     1                  EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT,  022575     288
     2                  EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY,  022575     289
     3         IDEBUG,  ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE,  022575     290
     4          MICRO,   RELME,  SPEC(6),    SPEC1,        T,   XCGSA1,  022575     291
     5                    XMER,     XMEU                                 022575     292
C                                                                        022575     293
      ICODE=0                                                            NASA      1152
C      CHECK S AND C                                                     NASA      1153
      IF (PDOTRX .LT. .01 .AND. NCONF(1) .EQ. 1) ICODE = -1             011675      28
      IF (PDOTRX .LT. .01 .AND. NCONF(1) .EQ. 3) ICODE=-1               NASA      1155
      IF (AMIN1(PHIRX,PHIRY,PHIRZ) .LT. .02 .AND. NCONF(1) .EQ. 2)      NASA      1156
     * ICODE=-1                                                          NASA      1157
C      MANEUVERABILITY IS MANV AND IS VALUES 1-4                         NASA      1158
      IF (MANV .EQ. 4 .AND. NCONF(1) .EQ. 1) ICODE=-1                   NASA      1159
C      PAYLOAD YAW IS 0 OR 1                                             NASA      1160
      IF (NCONF(1) .EQ. 4 .AND. NCONF(3) .EQ. 2) ICODE=-1               NASA      1162
C      IOPTCM(1) IS RANGING(1=YES),IOPTCM(2) IS SEPARATE LINK,AND       NASA      1163
C      IOPTCM(3) IS SEPARATE ANTENNAS                                    NASA      1164
      IF (IOPTCM.GT.0  .AND.  NCONF(4).EQ.1)  ICODE = -1                032475      11
      IF (NCONF(4) .LE. 3) GO TO 45                                      NASA      1169
      DO 43 I=1,11                                                       NASA      1170
      DO 43 J=1,3                                                        NASA      1171
      IF (ARRAYN(I,J) .GT. 0) GO TO 45                                   NASA      1172
   43 CONTINUE                                                           NASA      1173
      ICODE=-1                                                           NASA      1174
   45 CONTINUE                                                           NASA      1175
      IF (NCONF(5) .EQ. 1 .AND. NCONF(1) .LT. 3) ICODE=-1               NASA      1178
      IF (NCONF(5) .EQ. 3 .AND. NCONF(1) .LT. 3) ICODE=-1               NASA      1179
      IF (NCONF(5) .EQ. 5 .AND. NCONF(1) .LT. 3) ICODE=-1               NASA      1180
      IF (NCONF(6) .EQ. 2 .AND. NCONF(1) .LT. 3) ICODE = -1             011675      31
      RETURN                                                             011675      32
      END                                                                NASA      1183
```

```
      SUBROUTINE READDB(IENDDB)                                          NASA      1184
C      THIS READS THE DATAEASE FOR ONE SUBSYSTEM AT A TIME               NASA      1185
C      IDB IS SET AS THE DATABASE IS READ BY SCANNING EQUIP NUMBERS      NASA      1186
      DIMENSION STORE(55)                                                NASA      1187
      COMMON /DBCOM/DATAB(55,100),IDB(30)                                022575     294
C                                                                        022575     295
      DATA STORE/55*0./                                                  NASA      1189
      IF (IENDDB .LE. 1) GO TO 2                                         NASA      1190
      IF (STORE(1) .EQ. 0.) GO TO 2                                      NASA      1191
      DO 1 J=1,55                                                        NASA      1192
    1 DATAB(J,1)=STORE(J)                                                NASA      1193
      I=2                                                                NASA      1194
      IDOLD=STORE(1)/100.                                                NASA      1195
      IIDB=1                                                             NASA      1196
      GO TO 3                                                            NASA      1197
    2 I=1                                                                NASA      1198
      IDOLD=0                                                            NASA      1199
      IIDB=1                                                             NASA      1200
    3 READ (1,100) (DATAB(J,I),J=1,55)                                   101574      19
      IF (EOF(1))90,110                                                  101574      20
  100 FORMAT (E5.0,A2,3A6,5E10.0,/,5(8E10.0,/),5E10.0)                   NASA      1202
  110 IF (IDOLD .EQ. 0) IDOLD = DATAB(1,I)/100.                          101574      21
      ID=DATAB(1,I)/100.                                                 NASA      1204
C      TEST FOR ENI OF SUBSYSTEM                                         NASA      1205
      IF (ID .LT. IDOLD) GO TO 80                                        NASA      1206
C      TEST FOR NEW EQUIP TYPE                                           NASA      1207
      IF (ID .EQ. IDOLD) GO TO 4                                         NASA      1208
      IDB(IIDB)=I-1                                                      NASA      1209
      IIDB=IIDB+1                                                        NASA      1210
      IDOLD=ID                                                           NASA      1211
    4 I=I+1                                                              NASA      1212
      GO TO 3                                                            NASA      1213
C      HERE WHEN SWITCHING SUBSYSTEMS                                    NASA      1214
   80 DO 5 J=1,55                                                        NASA      1215
    5 STORE(J)=DATAB(J,I)                                                NASA      1216
      IDB(IIDB)=I-1                                                      NASA      1217
      IENDDB=I-1                                                         NASA      1218
      RETURN                                                             NASA      1219
   90 DO 6 J=1,55                                                        NASA      1220
    6 STORE(J)=0.                                                        NASA      1221
      IDB(IIDB)=I-1                                                      NASA      1222
      REWIND 1                                                           NASA      1223
      IENDDB=I-1                                                         NASA      1224
      RETURN                                                             NASA      1225
      END                                                                NASA      1226
```

```
      SUBROUTINE SAVE(IIN,NIN,NOWAT,ITEST,IENDDB)                        NASA      1227
C       THIS SUBROUTINE SAVES ICHOSE,NCHOSE,AND ANY PORTIONS OF          NASA      1228
C       THE DATABASE REQUIRED BY LATER SUBSYSTEMS OR ROUTINES            NASA      1229
      DIMENSION IIN(15),NIN(15)                                          NASA      1230
      COMMON /DBCOM/DATAB(55,100),IDB(30)                                022575     296
C                                                                        022575     297
      COMMON /CHOSE/     COST(5,60),      DPIA(11,60),     ICHOSE(60),   022575     298
     1                   NCHOSE(60),      REL ( 6,60),     SKD(7,60),    022575     299
     2                   THM(4,60)                                       022575     300
C                                                                        022575     301
      COMMON/PRTCOM/    ACCRCY,        AM,        AN,        BF,        BS,  022575  302
     1               CDPI(7,2),    CISTAR,      CTOT,      DDTE,        DE,  022575  303
     2                   DRIWT,    EGBSTR,    FEEINV,    FEEOPS,      FEER,  022575  304
     3                     GSE,      IREL,    ITRUNC,    MMDOLD,NAME(3,60),  022575  305
     4                     OPS,    PAYINV,    PAYQUL,      PAYR,        PE,  022575  306
     5                     PMP,       PMR,  POWER(6),        PU,   PWR(60),  022575  307
     6                     QCP,       QCF,  ROLD(60),    SABMWT,    SATADP,  022575  308
     7                  SATINV,      SATR,      SEIP,      SEIR,  SKTAU(6),  022575  309
     8                SSREL(6),   SUBE(7),   SUBT(7),  SUBUE(7),  SUBUP(7),  022575  310
     9                      TA,  TAU(6,6),        TB,        TC,        TE,  022575  311
     A                      TF,    TOOLR,     TOOLU,    TOTOPS,     TRUNC,  022575  312
     B                      TS,     TTT, VOLUME(6),   VQL(60), WEIGHT(6),  022575  313
     C                  XLTOT,      XMEH,    XMEINV,      XMEL,     XMEVL,  022575  314
     D                   XMEW,     XMEWT,     XVEST                        022575  315
      DIMENSION IDATAB(55,90)                                            111974      33
      EQUIVALENCE (IDATAB,DATAB)                                         111974      34
      DO 1 I=1,ITEST                                                     NASA      1234
      IF (IIN(I) .LE. 0) GO TO 1                                         NASA      1235
      ICHOSE(NOWAT)=IIN(I)                                               NASA      1236
      NCHOSE(NOWAT)=NIN(I)                                               NASA      1237
      DO 3 J=1,IENDDB                                                    NASA      1238
      IF (DATAB(1,J) .NE. IIN(I)) GO TO 3                                NASA      1239
      DO 2 KKK=1,5                                                       NASA      1240
    2 COST(KKK,NOWAT)=DATAB(45+KKK,J)                                    NASA      1241
      REL(1,NOWAT)=DATAB(23,J)                                           NASA      1242
      DO 4 KKK=2,6                                                       NASA      1243
    4 REL(KKK,NOWAT)=DATAB(39+KKK,J)                                     NASA      1244
      DO 5 KKK=1,11                                                      NASA      1245
    5 DPIA(KKK,NOWAT)=DATAB(29+KKK,J)                                    NASA      1246
      THM(1,NOWAT)=DATAB(17,J)                                           NASA      1247
      THM(2,NOWAT)=DATAB(18,J)                                           NASA      1248
      THM(3,NOWAT)=DATAB(27,J)                                           NASA      1249
      THM(4,NOWAT)=DATAB(28,J)                                           NASA      1250
      SKD(1,NOWAT)=DATAB(46,J)                                           NASA      1251
      SKD(2,NOWAT)=DATAB(47,J)                                           NASA      1252
      DO 6 KKK=3,7                                                       NASA      1253
    6 SKD(KKK,NOWAT)=DATAB(48+KKK,J)                                     NASA      1254
      VQL (NOWAT) = DATAB(24,J)                                          111874      35
      PWR(NOWAT) = DATAB(16,J)                                           111874      36
      DO 7 KKK=1,3                                                       111874      37
    7 NAME(KKK,NOWAT)=IDATAB(KKK+2,J)                                    111874      38
    3 CONTINUE                                                           NASA      1255
      NOWAT=NOWAT+1                                                      NASA      1256
    1 CONTINUE                                                           NASA      1257
```

```
      55                    RETURN                                                                                  NASA      1258
                            END                                                                                     NASA      1259
SUMMARY OF CHANGES MADE BY THE OPTIMIZER
13     WORDS OF INVARIANT RLIST REMOVED FROM THE LOOP BEGINNING AT LINE 33
13     WORDS OF INVARIANT RLIST REMOVED FROM THE LOOP BEGINNING AT LINE 36
13     WORDS OF INVARIANT RLIST REMOVED FROM THE LOOP BEGINNING AT LINE 38
13     WORDS OF INVARIANT RLIST REMOVED FROM THE LOOP BEGINNING AT LINE 46

REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 33
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 36
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 38
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 46
```

```
      SUBROUTINE THRML  (IERR,NCONF)                                     NASA      1260
      COMMON /USERI/    APOGEE,    COMRAT,    DIAMAX, EEQWT(9),     EPME,022575     316
     1                  EQM1WT,    EQM1XL,    EQM1YL,   EQM1ZL,   EQM2WT,022575     317
     2                  EQM2XL,    EQM2YL,    EQM2ZL,       FE,   IAGNCY,022575     318
     3        IDEBUG,   ISATOR,    MB12SH,    OPTEMP,   ORBINC,   PERIGE,022575     319
     4         MICRO,    RELME,   SPEC(6),     SPEC1,        T,   XCGSA1,022575     320
     5                   XMER,      XMEU                                 022575     321
C                                                                        022575     322
      COMMON /BTWN/      ACSSN,    ACSWP,        ALT,     AREA,   BATCAP,022575     323
     1              BITRAT(2),     CLIFE,    CONVWT,         D,       DT,022575     324
     2                     DX,        DY,        DZ,    EQBLG,   EQBSID,022575     325
     3                     FC,        FF,    HARNWT,      HPT,   HTPIPE,022575     326
     4                   HTPT,    HTRPRB,    HTRPWR,              IBTLOC,022575     327
     5                  LMBDD,        NC,     OMEGS,   PASSTR,       PJ,022575     328
     6                     PL,     PLMIN,    POCNWT,     RADA,    RADAB,022575     329
     7                    RAT,        RJ,    SABOLG,    SATLG,   SATTWT,022575     330
     8                  SATWT,    SATXCG,    SATYCG,   SATZCG,    SA1XL,022575     331
     9                  SA1YL,    SA1ZL,      SIDE,    SYSLB,   THCMWT,022575     332
     A              THRUST(2),        TI,     TNKWT,    TPRIM,       VB,022575     333
     B                   VCHP,       VOL,      WATE,       WB,      WBT,022575     334
     C                     WT,        XJ,    XNZERO,       YJ,       ZJ 022575     335
C                                                                        022575     336
      COMMON /CHOSE/     COST(5,60),      DPIA(11,60),     ICHOSE(60),   022575     337
     1                   NCHOSE(60),      REL ( 6,60),     SKD(7,60),    022575     338
     2                THRMDB(4,60)                                       022575     339
C                                                                        022575     340
      DIMENSION NCONF(6)                                                 NASA      1270
      REAL LNGTH                                                         NASA      1271
      DATA SIGMA/0.1714E-08/,QS/442.0/,EMISS/60.0/,ALBDO/155.0/,CONST/1. NASA      1272
     15/,PIE/3.1415926535/                                               NASA      1273
C ********************************************************************** NASA      1274
C ********************************************************************** NASA      1275
C **   SUBROUTINE THRML USES A METHODOLOGY FOR SIZING THE THERMAL     ** NASA      1276
C **   CONTROL SUB-SYSTEM FOR A VARIETY OF SPACECRAFT. THIS METHODOLOGY** NASA      1277
C **   DETERMINES SIZE AND PERFCRMANCE OF THE THERMAL SUB-SYSTEM      ** NASA      1278
C ********************************************************************** NASA      1279
C ********************************************************************** NASA      1280
C **   A GLOSSARY OF VARIABLES FOLLOWS - -                            ** NASA      1281
C ********************************************************************** NASA      1282
C **                                                                  ** NASA      1283
C **       CODE IS AS FOLLOWS - -                                     ** NASA      1284
C **            U = USER INPUT, DB = DATA BASE, INT = INTERNAL        ** NASA      1285
C **            O = OUTPUT, I = INPUT FROM MAIN OR OTHER S/S          ** NASA      1286
C ********************************************************************** NASA      1287
C **       VAR. NAME      CODE      UNITS (DEFAULT)     DESCRIPTION   ** NASA      1288
C **                                                                  ** NASA      1289
C ********************************************************************** NASA      1290
C **                                                                  ** NASA      1291
C **       ALBDO       INT        155 BTU/(HR*FT**2)      ALBEDO      ** NASA      1292
C **                                                                  ** NASA      1293
C **       ALPHA       INT        0.30 (DIMENSIONLESS)    CONV.RAD.CONST.** NASA   1294
C **                              0.08 (DIMENSIONLESS)    OSR. RAD.CONST.** NASA   1295
C **                                                                  ** NASA      1296
C **       ALT         U                        N.MI.     ALTITUDE    ** NASA      1297
```

```
C **                                                                 ** NASA      1298
C **    BV         INT         1.1              VDC      MAX BATT.VOLT. ** NASA      1299
C **                                                                 ** NASA      1300
C **    CA         INT         0.5              AMPS     BATT TRICKLE   ** NASA      1301
C **                                                                 ** NASA      1302
C **    CONST      INT         1.5                       K CONSTANT     ** NASA      1303
C **                                                                 ** NASA      1304
C **    EMISS      INT         60  BTU/(HR*FT**2)        EARTH EMISSION ** NASA      1305
C **                                                                 ** NASA      1306
C **    EPSLON     INT         0.75 (DIMENSIONLESS)      CONV.RAD.CONST.** NASA      1307
C **                           0.73 (DIMENSIONLESS)      OSR. RAD.CONST.** NASA      1308
C **                                                                 ** NASA      1309
C **    ETAT       INT                          XMTR EFFICIENCY        ** NASA      1310
C **                                                                 ** NASA      1311
C **    HPT        0                   (BTU/HR) TOTAL HEATER POWER   ** NASA      1312
C **                                                                 ** NASA      1313
C **    HTPIPE     0                   (BTU/HR) HEAT DUE TO H.P.     ** NASA      1314
C **                                                                 ** NASA      1315
C **    HTPT       0                   (BTU/HR)TOTAL HEAT PIPE       ** NASA      1316
C **                                                                 ** NASA      1317
C **    HTRPRB     0                   (BTU/HR)BATT. HEATER POWER    ** NASA      1318
C **                                                                 ** NASA      1319
C **    HTRPWR     0                   (BTU/HR)OTHER HEATER POWER    ** NASA      1320
C **                                                                 ** NASA      1321
C **    I          INT                          INDEX                  ** NASA      1322
C **                                                                 ** NASA      1323
C **    IBTLOC     I                            BATTERY LOCATION       ** NASA      1324
C **                                                                 ** NASA      1325
C **    ICONF      INT                          TYPE OF CONFIG.        ** NASA      1326
C **    ISATOR     U           1    (DIMENSIONLESS)      EARTH ORIENTED ** NASA      1327
C **                           2    (DIMENSIONLESS)      SUN   ORIENTED ** NASA      1328
C **                           3    (DIMENSIONLESS)      INERTIALLY ORI.** NASA      1329
C **                                                                 ** NASA      1330
C **    NC                                             NUMBER BATT CEL** NASA      1331
C **                                                                 ** NASA      1332
C **    NCONF(1)   I                                   S+C MACRO INDEX** NASA      1333
C **    NCONF(6)   I                                   VS  MACRO INDEX** NASA      1334
C **                                                                 ** NASA      1335
C **    ORBINC     U                        DEGREES    ORBIT INCLINAT.** NASA      1336
C **                                                                 ** NASA      1337
C **    PCM        0                          KG PHASE CHANGE MASS    ** NASA      1338
C **                                                                 ** NASA      1339
C **    PIE        INT                  3.14159265 CONSTANT              NASA      1340
C **                                                                 ** NASA      1341
C **                                                                 ** NASA      1342
C **    PMAX       INT  (DB)                   WATTS     PWR MAX        ** NASA      1343
C **                                                                 ** NASA      1344
C **    PMIN       INT  (DB)                   WATTS     PWR MIN        ** NASA      1345
C **                                                                 ** NASA      1346
C **    QMAX       INT                  (BTU/HR)         MAX PWR DISSAP.** NASA      1347
C **                                                                 ** NASA      1348
C **    QMAXB      INT                   (BTU/HR) BATT.POWER MAXIMUM ** NASA      1349
C **                                                                 ** NASA      1350
C **    QMIN       INT                  (BTU/HR)         MIN PWR DISSAP.** NASA      1351
C **                                                                 ** NASA      1352
C **    QMINB      INT                   (BTU/HR) BATT.POWER MINIMUM ** NASA      1353
C **                                                                 ** NASA      1354
```

```
C **       QS          INT         442.0  BTU/(HR*FT**2)      SOLAR CONST.   ** NASA      1355
C **                                                                         ** NASA      1356
C **       RADA        0                          (FT**2)     RADIATOR AREA  ** NASA      1357
C **                                                                         ** NASA      1358
C **       RADAB       0                            FT**2 BATT.RAD.AREA      ** NASA      1359
C **                                                                         ** NASA      1360
C **       RAT         0                            FT**2 TOTAL RAD. AREA    ** NASA      1361
C **                                                                         ** NASA      1362
C **       SATLG       I  (VS)                     INCHES     SAT. LENGTH    ** NASA      1363
C **                                                                         ** NASA      1364
C **       SATRAD      I  (VS)                     INCHES     SAT. RADIUS    ** NASA      1365
C **                                                                         ** NASA      1366
C **       SIGMA       INT         0.1714E-8BTU/(HR*FT2*R4) BOLTZMANN CONST** NASA      1367
C **                                                                         ** NASA      1368
C **       THRMDB      I                                 THERMAL DATA BASE      NASA      1369
C **                                                                         ** NASA      1370
C **       TMAX        INT  (DB)                   DEGREES R  MAX TEMPERATURE** NASA      1371
C **                                                                         ** NASA      1372
C **       TMAXB       INT                                 BATT. MAX. TEMP.  ** NASA      1373
C **                                                                         ** NASA      1374
C **       TMIN        INT  (DB)                   DEGREES R  MIN TEMPERATURE** NASA      1375
C **                                                                         ** NASA      1376
C **       TMINB       INT                                 BATT. MIN. TEMP.  ** NASA      1377
C **                                                                         ** NASA      1378
C **       VCHP        0                                   VAR.COND.HEAT PIPE ** NASA     1379
C **                                                                         ** NASA      1380
C **                                                                         ** NASA      1381
C **                                                                         ** NASA      1382
C ***************************************************************************** NASA      1383
C                                                                               NASA      1384
C ***************************************************************************** NASA      1385
C ***************************************************************************** NASA      1386
C *                                  2                                        * NASA      1387
C *                                                                           * NASA      1388
C *                     O        O                                            * NASA      1389
C *                     S     I  I                                            * NASA      1390
C *                     R     S  O        C     R                             * NASA      1391
C *                     +     O  D     O  O  H  A                             * NASA      1392
C *                     V     T  E     S  N  E  D                             * NASA      1393
C *                     C     H        R  V  A  I                             * NASA      1394
C *                     H     E  H  H        T  A                             * NASA      1395
C *                     E  P  R  E  E  R  R  E  T                             * NASA      1396
C *                     A  C  M  A  A  A  A  R  O                             * NASA      1397
C *                     T  M  A  T  T  D  D     R                             * NASA      1398
C *                  R        L        I  I  P                                * NASA      1399
C *                  A  P  M  I  P  P  A  A  O  A                             * NASA      1400
C *                  D  I  A  Z  I  I  T  T  W  R                             * NASA      1401
C *                  A  P  S  E  P  P  O  O  E  E                             * NASA      1402
C *                  B  E  S  R  E  E  R  R  R  A                             * NASA      1403
C *                                                                           * NASA      1404
C *       IERR   =   X  X  X  X  X  X  X  X  X  X                             * NASA      1405
C *                                                                           * NASA      1406
C *           WHERE  0  MEANS NO SUCH REQUIREMENT, OR                         * NASA      1407
C *                  1  MEANS WE HAVE THIS REQUIREMENT                        * NASA      1408
C *                                                                           * NASA      1409
C ***************************************************************************** NASA      1410
C ***************************************************************************** NASA      1411
```

```
C ****************************************************************** NASA      1412
C *                                                                * NASA      1413
C                                                                    NASA      1414
C **      INITIALIZATION FOLLOWS - -                                 NASA      1415
C                                                                    NASA      1416
      RADA=0.                                                        NASA      1417
      RADAB=0.                                                       NASA      1418
      RAT=0.0                                                        NASA      1419
      HTRPWR=0.                                                      NASA      1420
      HTRPRB=0.                                                      NASA      1421
      HPT=0.                                                         NASA      1422
      HTPIPE=0.                                                      NASA      1423
      VCHP=0.                                                        NASA      1424
      HTPT=0.                                                        NASA      1425
      TMAX=1.E+20                                                    NASA      1426
      TMIN=-1.E20                                                    NASA      1427
      PMAX=0.                                                        NASA      1428
      PMIN=0.0                                                       NASA      1429
      ETAT=1.0                                                       NASA      1430
      I=0                                                            NASA      1431
      SATRAD=.5*D                                                    NASA      1432
10    I=I+1                                                          NASA      1433
C                                                                    NASA      1434
C         SEARCH FOR MIN(MAX TEMP) AND MAX(MIN TEMP), AND            NASA      1435
C         ACCUMULATE THE POWER (EXCLUDING XMTRS AND BATTERIES)       NASA      1436
C                                                                    NASA      1437
      IF (ICHOSE(I).LE.0) GO TO 50                                   NASA      1438
C                                                                    NASA      1439
      IF (I.EQ.IBTLOC) GO TO 20                                      NASA      1440
C                                                                    NASA      1441
C                                                                    NASA      1442
      TMAX=AMIN1(TMAX,THRMDB(3,I))                                   NASA      1443
      TMIN=AMAX1(TMIN,THRMDB(4,I))                                   NASA      1444
      PMIN=THRMDB(2,I)+PMIN                                          NASA      1445
      PMAX=THRMDB(1,I)+PMAX                                          NASA      1446
      GO TO 10                                                       NASA      1447
C                                                                    NASA      1448
C **  HERE IF WE HAVE THE BATTERY                                    NASA      1449
C                                                                    NASA      1450
20    TMINB=THRMDB(4,I)+460.                                         NASA      1451
      TMAXB=THRMDB(3,I)+460.                                         NASA      1452
      GO TO 10                                                       NASA      1453
   50 CONTINUE                                                       NASA      1454
      QMIN=PMIN*3.41                                                 NASA      1455
      IF(PMAX*.5 .GT. PMIN) PMAX=PMAX*.5                             NASA      1456
      QMAX=PMAX*3.41                                                 NASA      1457
      TMAX=TMAX+460.                                                 NASA      1458
      TMIN=TMIN+460.                                                 NASA      1459
      ICONF=NCONF(6)                                                 NASA      1460
C                                                                    NASA      1461
      GO TO (60,70,80), ICONF                                        NASA      1462
C                                                                    NASA      1463
C **  SATELLITE LENGTH IN INCHES (MUST CONVERT TO CM)(FROM VS)    ** NASA      1464
C         (CYLINDER)                                                 NASA      1465
60    LNGTH=SATLG*2.54*0.75                                          NASA      1466
      GO TO 90                                                       NASA      1467
C                                                                    NASA      1468
```

```
C       SATELLITE LENGTH IN INCHES (MUST CONVERT TO CM)(FROM VS)        ** NASA      1469
C           (BOX)                                                          NASA      1470
70      LNGTH=SATLG*2.54*0.75                                              NASA      1471
        GO TO 90                                                           NASA      1472
C                                                                          NASA      1473
C       SATELLITE LENGTH IN INCHES (MUST CONVERT TO CM)(FROM VS)        ** NASA      1474
C           (SPHERE)                                                       NASA      1475
80      LNGTH=PIE*SATRAD*2.54                                              NASA      1476
C                                                                          NASA      1477
C                                                                          NASA      1478
90      CONTINUE                                                           NASA      1479
        IF (ALT.GT.19000.) GO TO 300                                       NASA      1480
        IF (ALT.LT.500.) GO TO 160                                         NASA      1481
        GO TO (130,100,100), ISATOR                                        NASA      1482
100     ICONF=NCONF(1)                                                     NASA      1483
        GO TO (120,120,110,110,110), ICONF                                 NASA      1484
C                                                                          NASA      1485
C **        ORBITS GT 500 BUT LT 19000 AND,                             ** NASA      1486
C **        SOLAR ORIENTED AND,                                         ** NASA      1487
C **        3-AXIS STABILIZED         (EQUATION 3.3.1.1)                ** NASA      1488
C                                                                          NASA      1489
110     ALPHA=0.30                                                         NASA      1490
        EPSLON=0.75                                                        NASA      1491
C                                                                          NASA      1492
C     * DETERMINE RADIATOR AREA                                            NASA      1493
C                                                                          NASA      1494
        RADA=QMAX/(SIGMA*EPSLON*TMAX**4-(EMISS*EPSLON))                    NASA      1495
C                                                                          NASA      1496
C     * DETERMINE HEATER POWER                                             NASA      1497
C                                                                          NASA      1498
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN)-(EMISS*EPSLON))    NASA      1499
C                                                                          NASA      1500
C     * DETERMINE HEAT PIPE                                                NASA      1501
C                                                                          NASA      1502
        HTPIPE=(QMAX*LNGTH)/3.41                                           NASA      1503
        IERR=10111                                                         NASA      1504
        GO TO 380                                                          NASA      1505
C                                                                          NASA      1506
C **        ORBITS GT 500 BUT LT 19000 AND,                             ** NASA      1507
C **        SOLAR ORIENTED AND,                                         ** NASA      1508
C **        SPIN STABILIZED           (EQUATION 3.3.1.2)                ** NASA      1509
C                                                                          NASA      1510
120     ALPHA=0.3                                                          NASA      1511
        EPSLON=0.75                                                        NASA      1512
C                                                                          NASA      1513
C     * DETERMINE RADIATOR AREA                                            NASA      1514
C                                                                          NASA      1515
        RADA=QMAX/(SIGMA*EPSLON*TMAX**4-(EMISS*EPSLON))                    NASA      1516
C                                                                          NASA      1517
C     * DETERMINE HEATER POWER                                             NASA      1518
C                                                                          NASA      1519
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN)-(EMISS*EPSLON))    NASA      1520
C                                                                          NASA      1521
C     * DETERMINE HEAT PIPE                                                NASA      1522
C                                                                          NASA      1523
        HTPIPE=((QMAX*LNGTH)/3.41)                                         NASA      1524
C                                                                          NASA      1525
```

```
      IERR=10111
      GO TO 380
C
130   ICONF=NCONF(1)
      GO TO (140,140,150,150,150), ICONF
C
C **       ORBITS GT 500 BUT LESS THAN 19000 AND,                        **
C **       EARTH ORIENTED AND,                                           **
C **       SPIN STABILIZED          (EQUATION 3.4.1.2)                   **
C
140   ALPHA=0.08
      EPSLON=0.73
C
C    * DETERMINE RADIATOR AREA
C
      RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(QS*ALPHA))
C
C    * DETERMINE HEATER POWER
C
      HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN))
C
C    * DETERMINE PCM
C
      PCM=(0.26*ALPHA*QS*RADA*CONST)/40.
C
C    * DETERMINE HEAT PIPE
C
      HTPIPE=(QMAX*LNGTH)/3.41
C
      IERR=10011011
      GO TO 380
C
C **       ORBITS GT 500 BUT LESS THAN 19000 AND,                        **
C **       EARTH ORIENTED AND,                                           **
C **       3-AXIS STABILIZED        (EQUATION 3.4.1.1)                   **
C
150   ALPHA=0.08
      EPSLON=0.73
C
C    * DETERMINE RADIATOR AREA
C
      RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(QS*ALPHA))
C
C    * DETERMINE HEATER POWER
C
      HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN))
C
C    * DETERMINE PCM
C
      PCM=(0.26*ALPHA*QS*RADA*CONST)/40.
C
C    * DETERMINE HEAT PIPE
C
      HTPIPE=(QMAX*LNGTH)/3.41
C
      IERR=10011011
      GO TO 380
```

```
C                                                                        NASA    1583
160   IF (ORBINC.GT.30.) GO TO 230                                       NASA    1584
C                                                                        NASA    1585
      GO TO (170,200,200), ISATOR                                        NASA    1586
C                                                                        NASA    1587
170   ICONF=NCONF(1)                                                     NASA    1588
C                                                                        NASA    1589
      GO TO (180,180,190,190,190), ICONF                                 NASA    1590
C                                                                        NASA    1591
C **      ORBIT LT 500, ORBITAL INCLINATION LE 30 DEGREES AND,        ** NASA    1592
C **      EARTH ORIENTED AND,                                         ** NASA    1593
C **      SPIN STABILIZED          (EQUATION 2.1.2.2)                 ** NASA    1594
C                                                                        NASA    1595
180   ALPHA=0.08                                                         NASA    1596
      EPSLON=0.73                                                        NASA    1597
C                                                                        NASA    1598
C   * DETERMINE RADIATOR AREA                                            NASA    1599
C                                                                        NASA    1600
      RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON/PIE)-(QS+ALBDO)*AL NASA    1601
     1PHA/PIE)                                                           NASA    1602
C                                                                        NASA    1603
C   * DETERMINE HEATER POWER                                             NASA    1604
C                                                                        NASA    1605
      HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN)-((EMISS*EPSLON)/PI NASA    1606
     1E))                                                                NASA    1607
C                                                                        NASA    1608
      IERR=1011                                                          NASA    1609
      GO TO 380                                                          NASA    1610
C                                                                        NASA    1611
C **      ORBIT LT 500, ORBITAL INCLINATION LE 30 DEGREES AND,        ** NASA    1612
C **      EARTH ORIENTED AND,                                         ** NASA    1613
C **      3-AXIS STABILIZED        (EQUATION 2.1.2.1)                 ** NASA    1614
C                                                                        NASA    1615
190   ALPHA=0.08                                                         NASA    1616
      EPSLON=0.73                                                        NASA    1617
C                                                                        NASA    1618
C   * DETERMINE RADIATOR AREA                                            NASA    1619
C                                                                        NASA    1620
      RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(ALPHA*QS))                      NASA    1621
C                                                                        NASA    1622
C     DETERMINE HEATER POWER                                             NASA    1623
C                                                                        NASA    1624
      HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)                     NASA    1625
C                                                                        NASA    1626
C   * DETERMINE PCM MASS                                                 NASA    1627
C                                                                        NASA    1628
      PCM=(0.26*QS*RADA*ALPHA*CONST)/40.                                 NASA    1629
C                                                                        NASA    1630
C   * DETERMINE ISOTHERMALIZER HEAT PIPE                                 NASA    1631
C                                                                        NASA    1632
      HTPIPE=(QMAX*LNGTH)/3.41                                           NASA    1633
C                                                                        NASA    1634
      IERR=11011011                                                      NASA    1635
      GO TO 380                                                          NASA    1636
C                                                                        NASA    1637
C                                                                        NASA    1638
C                                                                        NASA    1639
```

```
 200    ICONF=NCONF(1)
C
        GO TO (210,210,220,220,220), ICONF
C
C **    CRBIT LT 500, ORBITAL INCLINATION LE 30 DEGREES AND,              **
C **    SUN ORIENTED AND,                                                  **
C **    SPIN STABILIZED             (EQUATION 2.1.1.2)                     **
C
 210    ALPHA=0.08
        EPSLON=0.73
C
C     * DETERMINE RADIATOR AREA
C
        RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON)-(.5*ALBDO*ALPHA))
C
C     * DETERMINE HEATER POWER
C
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
C
C     * DETERMINE HEAT PIPES
C
        HTPIPE=(QMAX*LNGTH)/3.41
C
        IERR=10011
        GO TO 380
C
C **    CRBIT LT 500, OBITAL INCLINATION LE 30 DEGREES AND,               **
C **    SUN ORIENTED AND,                                                  **
C **    3-AXIS STABILIZED           (EQUATION 2.1.1.1)                     **
C
 220    ALPHA=0.08
        EPSLON=0.73
C
C     * DETERMINE RADIATOR AREA
C
        RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON)-(ALBDO*ALPHA))
C
C     * DETERMINE HEATER POWER
C
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
C
C     * DETERMINE HEAT PIPES
C
        HTPIPE=(QMAX*LNGTH)/3.41
C
        IERR=10011
        GO TO 380
C
C
C       HERE IF ORBINC GT 30
C
C
 230    GO TO (240,270,270), ISATOR
C
 240    ICONF=NCONF(1)
C
        GO TO (250,250,260,260,260), ICONF
```

```
C                                                                      NASA      1697
C **    ORBIT LT 500, ORBITAL INCLINATION GT 30 DEGREES AND,        ** NASA      1698
C **    EARTH ORIENTED AND,                                         ** NASA      1699
C **    SPIN STABILIZED                   (EQUATION 2.2.3.2)        ** NASA      1700
C                                                                      NASA      1701
250     ALPHA=.08                                                      NASA      1702
        EPSLON=.73                                                     NASA      1703
C                                                                      NASA      1704
C     * DETERMINE RADIATOR AREA                                        NASA      1705
C                                                                      NASA      1706
        RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON/PIE)-((QS+ALBDO)*A NASA   1707
       1LPHA/PIE))                                                     NASA      1708
C                                                                      NASA      1709
C     * DETERMINE HEATER POWER                                         NASA      1710
C                                                                      NASA      1711
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN-(EMISS*EPSLON/PIE))  NASA  1712
C                                                                      NASA      1713
        IERR=1011                                                      NASA      1714
        GO TO 380                                                      NASA      1715
C                                                                      NASA      1716
C **    ORBIT LT 500, ORBITAL INCLINATION GT 30 AND,                ** NASA      1717
C **    EARTH ORIENTED AND,                                         ** NASA      1718
C **    3-AXIS STABILIZED                 (EQUATION 2.2.3.1)        ** NASA      1719
C                                                                      NASA      1720
260     ALPHA=.08                                                      NASA      1721
        EPSLON=.73                                                     NASA      1722
C                                                                      NASA      1723
C     * DETERMINE RADIATOR AREA                                        NASA      1724
C                                                                      NASA      1725
        RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(ALPHA*QS))                  NASA      1726
C                                                                      NASA      1727
C     * DETERMINE HEATER POWER                                         NASA      1728
C                                                                      NASA      1729
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)                 NASA      1730
C                                                                      NASA      1731
C     * DETERMINE PCM MASS                                             NASA      1732
C                                                                      NASA      1733
        PCM=(0.26*QS*ALPHA*RADA*CONST)/40.                             NASA      1734
C                                                                      NASA      1735
C       DETERMINE ISOTHERMALIZER HEAT PIPE                             NASA      1736
C                                                                      NASA      1737
        HTPIPE=(QMAX*LNGTH)/3.41                                       NASA      1738
C                                                                      NASA      1739
        IERR=11011011                                                  NASA      1740
        GO TO 380                                                      NASA      1741
C                                                                      NASA      1742
C                                                                      NASA      1743
C                                                                      NASA      1744
270     ICONF=NCONF(1)                                                 NASA      1745
        GO TO (280,280,290,290,290), ICONF                             NASA      1746
C                                                                      NASA      1747
C **    ORBIT LT 500, ORBITAL INCLINATION GT 30 AND,                ** NASA      1748
C **    SUN ORIENTED AND,                                           ** NASA      1749
C **    SPIN STABILIZED                   (EQUATION 2.2.2.2)        ** NASA      1750
C                                                                      NASA      1751
280     ALPHA=.08                                                      NASA      1752
        EPSLON=.73                                                     NASA      1753
```

```
C                                                                          NASA    1754
C     * DETERMINE RADIATOR AREA                                            NASA    1755
C                                                                          NASA    1756
        RADA=QMAX/((SIGMA*EPSLCN*TMAX**4)-(EMISS*EPSLON)-(ALBDO*ALPHA))    NASA    1757
C                                                                          NASA    1758
C     * DETERMINE HEATER POWER                                             NASA    1759
C                                                                          NASA    1760
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN-(EMISS*EPSLON))      NASA    1761
C                                                                          NASA    1762
C     * DETERMINE PCM MASS                                                 NASA    1763
C                                                                          NASA    1764
        FCM=(0.26*ALPHA*ALBDO*RADA*CONST)/40.                              NASA    1765
C                                                                          NASA    1766
C     * DETERMINE HEAT PIPES                                               NASA    1767
C                                                                          NASA    1768
        HTPIPE=(QMAX*LNGTH)/3.41                                           NASA    1769
C                                                                          NASA    1770
        IERR=10011011                                                      NASA    1771
        GO TO 380                                                          NASA    1772
C                                                                          NASA    1773
C  **   ORBIT LT 500, ORBITAL INCLINATION GT 30 DEGREES                    NASA    1774
C  **   SUN ORIENTED AND,                                                  NASA    1775
C  **   3-AXIS STABILIZED                (EQUATION 2.2.2.1)                NASA    1776
C                                                                          NASA    1777
290     ALPHA=0.08                                                         NASA    1778
        EPSLON=0.73                                                        NASA    1779
C                                                                          NASA    1780
C     * DETERMINE RADIATOR AREA                                            NASA    1781
C                                                                          NASA    1782
        RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON)-(ALBDO*ALPHA))    NASA    1783
C                                                                          NASA    1784
C     * DETERMINE HEATER POWER                                             NASA    1785
C                                                                          NASA    1786
        HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN-(EMISS*EPSLON))      NASA    1787
C                                                                          NASA    1788
C     * DETERMINE PCM MASS                                                 NASA    1789
C                                                                          NASA    1790
        FCM=(0.26*ALPHA*ALBDO*RADA*CONST)/40.                              NASA    1791
C                                                                          NASA    1792
C     * DETERMINE HEAT PIPES                                               NASA    1793
C                                                                          NASA    1794
        HTPIPE=(QMAX*LNGTH)/3.41                                           NASA    1795
C                                                                          NASA    1796
        IERR=10011011                                                      NASA    1797
        GO TO 380                                                          NASA    1798
C                                                                          NASA    1799
C       HERE IF ORBIT GT 19000                                             NASA    1800
C                                                                          NASA    1801
300     GO TO (340,310,310), ISATOR                                        NASA    1802
C                                                                          NASA    1803
310     ICONF=NCONF(1)                                                     NASA    1804
        GO TO (320,320,330,330,330), ICONF                                 NASA    1805
C                                                                          NASA    1806
C  **   ORBIT GT 19000 AND                                              ** NASA    1807
C  **   SOLAR INERTALLY ORIENTED AND,                                   ** NASA    1808
C  **   SPIN STABILIZED                  (EQUATION 1.1.1.2)             ** NASA    1809
C                                                                          NASA    1810
```

```
320    ALPHA=0.30                                                     NASA     1811
       EPSLON=0.75                                                    NASA     1812
C                                                                     NASA     1813
C    * DETERMINE RADIATOR AREA                                        NASA     1814
C                                                                     NASA     1815
       RADA=QMAX/(SIGMA*EPSLON*TMAX**4)                               NASA     1816
C                                                                     NASA     1817
C    * DETERMINE HEATER POWER                                         NASA     1818
C                                                                     NASA     1819
       HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)                 NASA     1820
C                                                                     NASA     1821
C    * DETERMINE HEAT PIPES                                           NASA     1822
C                                                                     NASA     1823
       HTPIPE=(QMAX*LNGTH)/3.41                                       NASA     1824
C                                                                     NASA     1825
       IERR=10111                                                     NASA     1826
       GO TO 380                                                      NASA     1827
C                                                                     NASA     1828
C **   ORBIT GT 19000 AND,                                         ** NASA     1829
C **   SOLAR INERTIALLY ORIENTED AND                               ** NASA     1830
C **   3-AXIS STABILIZED              (EQUATION 1.1.2)             ** NASA     1831
C                                                                     NASA     1832
330    ALPHA=0.30                                                     NASA     1833
       EPSLON=0.75                                                    NASA     1834
C                                                                     NASA     1835
C    * DETERMINE RADIATOR AREA                                        NASA     1836
C                                                                     NASA     1837
       RADA=(2.*QMAX)/(SIGMA*EPSLON*TMAX**4)                          NASA     1838
C                                                                     NASA     1839
C    * DETERMINE HEATER POWER                                         NASA     1840
C                                                                     NASA     1841
       HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4/2.)-QMIN)              NASA     1842
C                                                                     NASA     1843
C    * DETERMINE DIODE HEAT PIPE (2 REG-D)                            NASA     1844
C                                                                     NASA     1845
       HTPIPE=(QMAX*LNGTH)/3.41                                       NASA     1846
C                                                                     NASA     1847
       IERR=110111                                                    NASA     1848
       GO TO 380                                                      NASA     1849
C                                                                     NASA     1850
C                                                                     NASA     1851
C                                                                     NASA     1852
340    ICONF=NCONF(1)                                                 NASA     1853
       GO TO (350,360,370,370,360), ICONF                             NASA     1854
C                                                                     NASA     1855
C **   ORBIT GT 19000 AND,                                         ** NASA     1856
C **   EARTH ORIENTED AND,                                         ** NASA     1857
C **   DUAL OR NORMAL SPIN STABILIZED(EQUATION 1.2.3)              ** NASA     1858
C                                                                     NASA     1859
350    ALPHA=0.30                                                     NASA     1860
       EPSLON=0.75                                                    NASA     1861
C                                                                     NASA     1862
C    * DETERMINE RADIATOR AREA                                        NASA     1863
C                                                                     NASA     1864
       RADA=QMAX/(SIGMA*EPSLON*TMAX**4)                               NASA     1865
C                                                                     NASA     1866
C    * DETERMINE HEATER POWER                                         NASA     1867
```

```
C                                                                       NASA  1868
      HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)                    NASA  1869
C                                                                       NASA  1870
C   * DETERMINE HEAT PIPES                                              NASA  1871
C                                                                       NASA  1872
      HTPIPE=(QMAX*LNGTH)/3.41                                          NASA  1873
C                                                                       NASA  1874
      IERR=10111                                                        NASA  1875
      GO TO 380                                                         NASA  1876
C                                                                       NASA  1877
C **  ORBIT GT 19000 AND                                              ** NASA  1878
C **  YAW SPIN STABILIZED          (EQUATION 1.2.2)                  ** NASA  1879
C                                                                       NASA  1880
360   ALPHA=0.08                                                        NASA  1881
      EPSLON=0.73                                                       NASA  1882
C                                                                       NASA  1883
C   * DETERMINE RADIATOR AREA                                           NASA  1884
C                                                                       NASA  1885
      RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(QS*ALPHA/PIE))                 NASA  1886
C                                                                       NASA  1887
C   * DETERMINE HEATER POWER                                            NASA  1888
C                                                                       NASA  1889
      HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)                    NASA  1890
C                                                                       NASA  1891
      IERR=1011                                                         NASA  1892
      GO TO 380                                                         NASA  1893
C                                                                       NASA  1894
C **  ORBIT GT 19000 AND,                                             ** NASA  1895
C **  EARTH ORIENTED AND,                                             ** NASA  1896
C **  3-AXIS STABILIZED            (EQUATION 1.2.1)                  ** NASA  1897
C                                                                       NASA  1898
370   ALPHA=0.30                                                        NASA  1899
      EPSLON=0.75                                                       NASA  1900
C                                                                       NASA  1901
C   * DETERMINE RADIATOR AREA                                           NASA  1902
C                                                                       NASA  1903
      RADA=(2.*QMAX)/(SIGMA*EPSLON*TMAX**4)                             NASA  1904
C                                                                       NASA  1905
C   * DETERMINE HEATER POWER                                            NASA  1906
C                                                                       NASA  1907
      HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4/2.)-QMIN)                 NASA  1908
C                                                                       NASA  1909
C   * DETERMINE DIODE HEAT PIPE (2 REG-D)                               NASA  1910
C                                                                       NASA  1911
      HTPIPE=(QMAX*LNGTH)/3.41                                          NASA  1912
C                                                                       NASA  1913
      IERR=110111                                                       NASA  1914
      GO TO 380                                                         NASA  1915
C                                                                       NASA  1916
C ***     HERE WE WILL SIZE THE BATTERY THERMAL CONTROL NETWORK         NASA  1917
C ***                                                                   NASA  1918
C ***                                                                   NASA  1919
C                                                                       NASA  1920
380   CA=.5                                                             NASA  1921
      BV=1.5                                                            NASA  1922
      ALPHA=0.08                                                        NASA  1923
      EPSLON=0.73                                                       NASA  1924
```

```
      QMAXB=NC*CA*BV*3.41                                               NASA    1925
      QMINB=0.                                                          NASA    1926
C                                                                       NASA    1927
C   * DETERMINE RADIATOR AREA FOR BATTERY                               NASA    1928
C                                                                       NASA    1929
      RADAB=QMAXB/((SIGMA*EPSLON*(TMAXB-30.)**4)-(QS*ALPHA))            NASA    1930
C                                                                       NASA    1931
C   * DETERMINE HEATER POWER FOR BATTERY                                NASA    1932
C                                                                       NASA    1933
C                                                                       NASA    1934
      HTRPRB=1.25*(SIGMA*EPSLON*RADAB*(TMINB)**4-QMINB)                 NASA    1935
C                                                                       NASA    1936
C   * DETERMINE VARIABLE CONDUCTANCE HEAT PIPE                          NASA    1937
C                                                                       NASA    1938
      VCHP=QMAXB*LNGTH/3.41                                             NASA    1939
      IERR=IERR+1100000000                                              NASA    1940
C                                                                       NASA    1941
C                                                                       NASA    1942
C                                                                       NASA    1943
      HTPIPE = HTPIPE / 2.54                                            NASA    1944
      VCHP = VCHP / 2.54                                                NASA    1945
      RAT=RADA+RADAB                                                    NASA    1946
      HPT=HTRPWR+HTRPRB                                                 NASA    1947
      HTPT=HTPIPE+VCHP                                                  NASA    1948
C                                                                       NASA    1949
C                                                                       NASA    1950
      RETURN                                                            NASA    1951
C                                                                       NASA    1952
      END                                                               NASA    1953
```

```
      SUBROUTINE COMM (IPIC,IERR,ITER,MCONF,ICHOSE,NCHOSE)              NASA      1954
      INTEGER RESET,SEO,SSS,GRP                                         NASA      1955
      REAL LMARG,NF,MODLOS,IBER                                         NASA      1956
      DIMENSION IPIC(9),ICHOSE(11),NCHOSE(11),KPIC(9),MCONF(6),         NASA      1957
     * KCHOSE(11),PW(2),ISPFLG(2),J2SAVE(2)                             021375       1
      DIMENSION SIGNOI(2),LMARG(2),TCLOSS(2),GT(2),MODX(2)              NASA      1959
      DIMENSION BER(14,3),IBER(14),BESSJ(2),LIMPIC(9)                   NASA      1960
      COMMON /USER4/BWIDTH(2),  FREQX(2),     FREQR,   IOPTCM,     LINK, 032475     12
     1                NADIR,       NET                                  022575     342
C                                                                       022575     343
      COMMON /USERI/    APOGEE,    COMRAT,    DIAMAX, EEQWT(9),    EPME, 022575     344
     1                  EQM1WT,    EQM1XL,    EQM1YL,   EQM1ZL,  EQM2WT, 022575     345
     2                  EQM2XL,    EQM2YL,    EQM2ZL,       FE,  IAGNCY, 022575     346
     3         IDEBUG,     SEO,    ME12SH,    OPTEMP,   ORBINC,  PERIGE, 022575     347
     4          MICRO,   RELME,   SPEC(6),     SPEC1,    XDUM1,  XCGSA1, 022575     348
     5                    XMER,      XMEU                               022575     349
C                                                                       022575     350
      COMMON /BTWN/       ACSSN,     ACSHP,      ALT,     AREA,  BATCAP, 022575     351
     1              BITRAT(2),     CLIFE,   CONVWT,        D,      DT, 022575     352
     2                      DX,        DY,       DZ,    EQBLG,  EQBSID, 022575     353
     3                      FC,        FF,   HARNWT,      HPT,  HTPIPE, 022575     354
     4                    HTPT,    HTRPRB,   HTRPWR,            IBTLOC, 022575     355
     5                   LMBOD,        NC,    OMEGS,   PASSTR,      PJ, 022575     356
     6                      PL,     PLMIN,   POCNWT,     RADA,   RADAB, 022575     357
     7                     RAT,        RJ,   SABOLG,    SATLG,  SATTWT, 022575     358
     8                   SATWT,    SATXCG,   SATYCG,   SATZCG,   SA1XL, 022575     359
     9                   SA1YL,     SA1ZL,     SIDE,    SYSLB,  THCMWT, 022575     360
     A               THRUST(2),        TI,    TNKWT,    TPRIM,      VB, 022575     361
     B                    VCHP,       VOL,     WATE,       WB,     WBT, 022575     362
     C                      WT,        XJ,   XNZERO,       YJ,      ZJ  022575     363
C                                                                       022575     364
      COMMON /DBCOM/DATAB(55,100),IDB(30)                               022575     365
C                                                                       022575     366
      EQUIVALENCE (J1,KPIC(1)), (J7,KPIC(6)), (J4,KPIC(7)), (J5,KPIC(8)) NASA      1970
     1, (J6,KPIC(9))                                                    NASA      1971
      DATA      SIGNOI /10.,10./,  LMARG   /6.,6./, SLANT /-1.E10/,     NASA      1973
     *          GTOT /-1.E10/, GR/-1.E10/, T/-1.E10/, NF /-1.E10/,      NASA      1974
     *          TCLOSS / 0.,0./, POLOSS /0./, GAMMA /.1/, BETA /1.8/,   NASA      1975
     *          GT /-1.E10,-1.E10/,  MODX /0,0/, ANTLOS /0./,           NASA      1976
     *          COVER /0./,GRP /0/                                      NASA      1977
C BER IS BIT ERROR RATE DEGRADATION CUE TO HARDWARE                     NASA      1978
C IBER IS ARRAY OF DATA RATES                                           NASA      1979
      DATA IBER/.25,.50,1.0,2.0,4.0,8.0,16.,32.,64.,128.,256.,512.,768., NASA      1980
     11024./                                                            NASA      1981
      DATA BER/8*4.4,4.6,5*5.5,8*2.4,2.4,2.5,4*3.3,10*4.0,3.9,          NASA      1982
     13.3,3.4,4.1/                                                      NASA      1983
      DATA IB1/6/,IB2/9/,IB3/11/,IA1/10/,IT1/11/,IT2/6/,IT3/12/,IT4/13/, NASA      1984
     1IT5/7/,IT6/14/,IT7/9/,IT8/8/,IT9/10/,IT10/15/,IR1/6/,IR2/10/,IR3/1 NASA      1985
     25/,IC1/7/,IC2/6/,IC3/12/,ID1/6/,ID2/11/                           NASA      1986
      J2SAVE(1) = IPIC(2)                                               021375       2
      J2SAVE(2) = IPIC(3)                                               021375       3
      IF (ITER .GT. 0) GO TO 3                                          NASA      1987
      CO 2 I=1,11                                                       NASA      1988
    2 NCHOSE(I)=1                                                       NASA      1989
```

```
      PW(1) = 0.                                                        021275       2
      PW(2) = 0.                                                        021275       3
      ISPFLG(1) = 0                                                     021275       4
      ISPFLG(2) = 0                                                     021275       5
    3 IF (ITER .EQ. 0 .AND. IPIC(4) .EQ. 0)IC=0                         NASA      1990
      NCONF = MCONF(4)                                                  NASA      1991
      DO 1 I=1,2                                                        NASA      1992
    1 BITRAT(I) = .001 * BITRAT(I)                                      NASA      1993
      SSS=0                                                             NASA      1994
      IF (MCONF(1).EQ.1) SSS = 1                                        110174       1
      INX=1                                                             NASA      1996
      IF (NCONF.EQ.4.OR.NCONF.EQ.5) INX=2                               NASA      1997
C INITIALIZATION OF IPIC AND ICHOSE                                     NASA      1998
      ICC=IC+1                                                          NASA      1999
      IF (ITER.NE.0) ICC=1                                              NASA      2000
      IF (ITER.EQ.0 .AND. IPIC(4).GT.0) ICC=1                           020675       1
      DO 10 I=ICC,9                                                     NASA      2001
10    KCHOSE(I)=0                                                       NASA      2002
      DO 20 I=1,9                                                       NASA      2003
      KPIC(I)=IPIC(I)                                                   NASA      2004
20    IF (ITER.EQ.0.AND.IPIC(I).EQ.0) KPIC(I)=RESET(I)                  NASA      2005
      F1=0.                                                             NASA      2006
      IF (NCONF .EQ. 2 .OR. NCONF .EQ. 4)F1=1.                          NASA      2007
      IF (F1 .EQ. 0.) KPIC(9)=0                                         NASA      2008
      IF (F1 .EQ. 1.) KPIC(6)=0                                         NASA      2009
      IF (ITER.NE.0) IC=0                                               NASA      2010
      IF (IPIC(4) .NE. 0) IC=0                                          020675       2
      IF (IC.NE.0) GO TO 700                                            NASA      2011
      LIMPIC(1)=IDB(1)                                                  NASA      2012
      LIMPIC(2)=IDB(2)                                                  NASA      2013
      LIMPIC(3)=IDB(2)                                                  NASA      2014
      LIMPIC(4)=IDB(3)                                                  NASA      2015
      LIMPIC(5)=IDB(3)                                                  NASA      2016
      LIMPIC(6)=IDB(2)                                                  NASA      2017
      LIMPIC(7)=IDB(4)                                                  NASA      2018
      LIMPIC(8)=IDB(5)                                                  NASA      2019
      LIMPIC(9)=IDB(6)                                                  NASA      2020
      CALL BESS (BETA,BESSJ,1)                                          NASA      2021
30    CONTINUE                                                          NASA      2022
      IF (NCONF.GE.4.OR.BITRAT(2).EQ.0) GO TO 40                        NASA      2023
      BITRAT(1)=(BITRAT(1)+BITRAT(2))*1.3                               NASA      2024
40    CONTINUE                                                          NASA      2025
      RATE1=IBER(1)                                                     NASA      2026
      RATE2=0                                                           NASA      2027
      DO 50 I=1,13                                                      NASA      2028
      IF (BITRAT(1).GT.IBER(I)) RATE1=IBER(I+1)                         NASA      2029
      IF (BITRAT(2) .GT. IBER(I)) RATE2 = IBER(I+1)                     101574      22
   50 CONTINUE                                                          101574      23
      BITRAT(1)=RATE1                                                   NASA      2031
      BITRAT(2)=RATE2                                                   NASA      2032
      IF (NCONF.EQ.1) GO TO 90                                          NASA      2035
      IERR=1                                                            NASA      2036
      IF (LINK.EQ.0) GO TO 770                                          010675      21
C SGLS BBAU SELECTED ******************************************************   NASA      2038
      IERR=0                                                            NASA      2039
      IC=1                                                              NASA      2040
C ONE HOUSKEEPING BIT STREAM ONLY  (THIS SEMESTER)                      NASA      2041
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C 1 IS SGLS  2 IS USB                                                    NASA      2042
60     IF (DATAB(IB1,J1).EQ.1) GO TO 70                                  NASA      2043
       J1=J1+1                                                           NASA      2044
       IF (J1.GT.IDB(1)) GO TO 760                                       NASA      2045
       GO TO 60                                                          NASA      2046
70     IF (BITRAT(1).GT. 128.) GO TO 80                                  NASA      2047
       IF (ABS(DATAB(IB2,J1)-1.024) .LT. .01) GO TO 690                  NASA      2048
       J1=J1+1                                                           NASA      2049
       IF (J1.GT.IDB(1)) GO TO 760                                       NASA      2050
       GO TO 60                                                          NASA      2051
80     IERR=2                                                            NASA      2052
       IF (BITRAT(1).NE.256) GO TO 770                                   NASA      2053
       IERR=0                                                            NASA      2054
       IF (DATAB(IB2,J1).EQ.1.7) GO TO 690                               NASA      2055
       J1=J1+1                                                           NASA      2056
       IF (J1.GT.IDB(1)) GO TO 760                                       NASA      2057
       GO TO 60                                                          NASA      2058
C END OF BBAU SELECTION                                                   NASA      2059
90     IC=2                                                              NASA      2060
       KXMTR=1                                                           NASA      2061
       GO TO 110                                                         NASA      2062
100    IC=3                                                              NASA      2063
       KXMTR=2                                                           NASA      2064
110    CONTINUE                                                          NASA      2065
C                                                                        NASA      2066
C ANTENNA SELECTION ******************************************************* NASA   2067
       J2=KPIC(IC)                                                       NASA      2068
       IF (ISFFLG(KXMTR) .EQ. 1) GO TO 251                               021275       6
       IF (SEO .NE. 1) GO TO 250                                         021075       2
       IF (SSS.EQ.0) GO TO 160                                           NASA      2070
       IF (ALT.GT.12000) GO TO 140                                       NASA      2071
C OMNI    (B OMNI)                                                       NASA      2072
  120 IF (DATAB(IA1,J2).EQ.11.) GO TO 299                                021175       1
       J2=J2+1                                                           NASA      2074
       IF (J2.GT.IDB(2)) GO TO 760                                       NASA      2075
       GO TO 120                                                         NASA      2076
140    IERR=30                                                           NASA      2083
       IF (ALT .GT. 20000.) GO TO 770                                    011675      33
       IERR=0                                                            NASA      2085
C BICCNICAL    (A)                                                       NASA      2088
  150 IF (DATAB(IA1,J2).EQ.21.) GO TO 299                                021175       2
       J2=J2+1                                                           NASA      2090
       IF (J2.GT.IDB(2)) GO TO 760                                       NASA      2091
       GO TO 150                                                         NASA      2092
160    IF (ALT.GT.7000) GO TO 210                                        NASA      2093
       IF (NADIR.EQ.0) GO TO 190                                         NASA      2094
C      CONICAL SPIRAL (F2)                                               NASA      2097
  180 IF (DATAB(IA1,J2).EQ.41.) GO TO 299                                021175       3
       J2=J2+1                                                           NASA      2099
       IF (J2 .GT. IDB(2)) GO TO 760                                     NASA      2100
       GO TO 180                                                         021175       4
  190 IF (GRP .EQ. 0.) GO TO 180                                         021175       5
C MONOPOLE     (F1)                                                      NASA      2105
  200 IF (DATAB(IA1,J2).EQ.51.) GO TO 299                                021175       6
       J2=J2+1                                                           NASA      2107
       IF (J2 .GT. IDE(2)) GO TO 760                                     NASA      2108
       GO TO 200                                                         NASA      2109
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  210 IF (ALT .GT. 12000.) GO TO 230                                  NASA      2110
C                                                                     NASA      2111
C HELIX  (F3)                                                         NASA      2114
  220 IF (DATAB(IA1,J2).EQ.31.) GO TO 299                             021175       7
      J2=J2+1                                                         NASA      2116
      IF (J2.GT.IDB(2)) GO TO 760                                     NASA      2117
      GO TO 220                                                       NASA      2118
  230 IERR=30                                                         NASA      2119
      IF (ALT .GT. 20000.) GO TO 770                                  011675      34
      IERR=0                                                          NASA      2121
C                                                                     NASA      2122
C PARABOLA   (B HIGH GAIN)                                            NASA      2125
  240 IF (DATAB(IA1,J2).EQ. 1.) GO TO 299                             021175       8
      J2=J2+1                                                         NASA      2127
      IF (J2.GT.IDB(2)) GO TO 760                                     NASA      2128
      GO TO 240                                                       NASA      2129
C                                                                     NASA      2130
C STEERABLE PARABOLA OPTION WILL BE INCLUDED NEXT SEMESTER            NASA      2131
  250 IF (ISPFLG(KXMTR) .EQ. 1) GO TO 251                             021275       7
      IF (ALT .LE. 12000.) GC TO 120                                  021275       8
      IF (BITRAT(KXMTR).LT. 10) GO TO 120                             021075       3
  251 IERR = 1001                                                     021275       9
  255 IF (DATAB(IA1,J2).EQ. 1.) GO TO 299                             021175       9
      J2 = J2 + 1                                                     021075       8
      IF (J2 .GT. IDB(2)) GO TO 760                                   021075       9
      GO TO 255                                                       021075      10
260   KXMTR=1                                                         NASA      2135
      GO TO 280                                                       NASA      2136
270   KXMTR=2                                                         NASA      2137
280   CONTINUE                                                        NASA      2138
      LUNI=0                                                          NASA      2139
      IF (NCONF.GT.1.AND.KXMTR.EQ.1) LUNI=1                           NASA      2140
C                                                                     NASA      2141
C SPACE LOSS                                                          NASA      2142
      IF (SLANT.EQ.-1.E+10) SLANT=SQRT(APOGEE*(APOGEE+6880))          NASA      2143
      SLOSS=37.8+20*ALOG10(FREQX(KXMTR)*SLANT)                        NASA      2144
C                                                                     NASA      2145
C G TO T                                                              NASA      2146
      IF (GTOT.NE.-1.E+10) GO TO 320                                  NASA      2147
      IF (GR.NE.-1.E+10.AND.T.NE.-1.E+10) GO TO 310                   NASA      2148
      IF (NF.NE.-1.E+10.AND.GR.NE.-1.E+10) GO TO 300                  NASA      2149
C NET.EQ.0 FCR AFSCF    NET.NE.C FOR NASA                             NASA      2150
      IF (NET.EQ.0) GO TO 290                                         NASA      2151
      GR=44                                                           NASA      2152
      T=170                                                           NASA      2153
      GO TO 310                                                       NASA      2154
290   GR=47.5                                                         NASA      2155
      T=220                                                           NASA      2156
      GO TO 310                                                       NASA      2157
  299 GT(KXMTR) = DATAB(IT1,J2)                                       021175      10
      GO TO 690                                                       021175      11
300   T=(10.**(NF/10)-1)*290.                                         NASA      2158
310   GTOT=GR-10*ALOG10(T)                                            NASA      2159
320   CONTINUE                                                        NASA      2160
C                                                                     NASA      2161
C TRANSMITTER CIRCUIT LOSS                                            NASA      2162
      IF (TCLOSS(KXMTR).NE.0) GO TO 330                               NASA      2163
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      TCLOSS(KXMTR)=1.0                                                 NASA      2164
      IF (LUNI.EQ.1.AND.(NCONF.EQ.2.OR.NCONF.EQ.4)) TCLOSS(KXMTR)=1.5   NASA      2165
330   CONTINUE                                                          NASA      2166
C                                                                       NASA      2167
C MODULATION LOSS                                                       NASA      2168
      MODLOS=0                                                          NASA      2169
      IF (LUNI.EQ.0) GO TO 340                                          NASA      2170
      IERR=10                                                           NASA      2171
      IF(LINK.EQ.0)GO TO 770                                            010675      22
      IERR=0                                                            NASA      2173
C BESSJ(2)=J1(BETA)   /   BESSJ(1)=J0(BETA)                             NASA      2174
      MODLOS=ABS(10*ALOG10(2*(BESSJ(2)*COS(GAMMA))**2))                 NASA      2175
340   CONTINUE                                                          NASA      2176
C HARDWARE DEGRDATION LOSS                                              NASA      2177
      IF (LUNI.EQ.1) GO TO 360                                          NASA      2178
      DO 350 I=1,14                                                     NASA      2179
      IF (BITRAT(KXMTR) .EQ. IBER(I)) HDLOSS = BER(I,3)                 101574      24
  350 CONTINUE                                                          101574      25
      GO TO 380                                                         NASA      2181
360   IERR=10                                                           NASA      2182
      IF (LINK .EQ. 0) GO TO 770                                        011475      18
      IERR=0                                                            NASA      2184
      IK=2                                                              NASA      2185
      IF (DATAB(IB2,J1).EQ.1.024) IK=1                                  NASA      2186
      DO 370 I=1,14                                                     NASA      2187
      IF (BITRAT(1) .EQ. IBER(I)) HDLOSS = BER(I,IK)                    101574      26
  370 CONTINUE                                                          101574      27
C BANDWIDTH IN DB                                                       NASA      2189
380   IF (BWIDTH(KXMTR).EQ.-1.E+10) BWIDTH(KXMTR)=BITRAT(KXMTR)*1000    NASA      2190
      B=10*ALOG10(BWIDTH(KXMTR))                                        NASA      2191
C                                                                       NASA      2192
C CALCULATION OF ERP                                                    NASA      2193
      ERP=SIGNOI(KXMTR)+SLOSS+B-GTOT+LMARG(KXMTR)+TCLOSS(KXMTR)+POLOSS+A NASA      2194
     1NTLOS+MODLOS+HDLOSS-228.6                                         NASA      2195
      PW(KXMTR) = 10. **((ERP-GT(KXMTR))/10.)                           021275      10
      PRINT 385,KXMTR,PW(KXMTR)                                         021275      11
  385 FORMAT( 4H PW(,I1,4H) = ,E11.4)                                   021275      12
C                                                                       NASA      2197
C TRANSMITTER SELECTION ********************************************** NASA      2198
      IF (PW(KXMTR).LT.20. .OR. DATAB(IA1,J2).EQ.1.) GO TO 388          021275      13
      IC = KXMTR + 1                                                    021175      13
      ISPFLG(KXMTR) = 1                                                 021275      14
      IF (J2SAVE(KXMTR).GT. 0 .AND. ITER.EQ.0) J2 = J2SAVE(KXMTR)       021375       4
      GO TO 250                                                         021175      14
  388 KNSTRA = 0                                                        021175      15
      IC=KXMTR+3                                                        NASA      2200
      J3=KPIC(IC)                                                       NASA      2201
390   IF (LUNI.EQ.0) GO TO 440                                          NASA      2202
400   IF (DATAB(IT1,J3).EQ.1) GO TO 410                                 NASA      2203
      J3=J3+1                                                           NASA      2204
      IF (J3.GT.IDB(3)) GO TO 760                                       NASA      2205
      GO TO 400                                                         NASA      2206
410   IF (DATAB(IB3,J1).EQ.0) GO TO 420                                 NASA      2207
      KNSTRA=1                                                          NASA      2208
      IF (DATAB(IB3,J1).EQ.DATAB(1,J3)) GO TO 460                       NASA      2209
      J3=J3+1                                                           NASA      2210
      IF (J3.GT.IDB(3)) GO TO 760                                       NASA      2211
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      GO TO 400                                                         NASA      2212
  420 IF (DATAB(IT2,J3).EQ.0) GO TO 430                                 NASA      2213
      J3=J3+1                                                           NASA      2214
      IF (J3.GT.IDB(3)) GO TO 760                                       NASA      2215
      GO TO 400                                                         NASA      2216
  430 IF (DATAB(IB2,J1).EQ.DATAB(IT3,J3).OR.DATAB(IB2,J1)               101574      28
     * .EQ. DATAB(IT4,J3)) GO TO 460                                    NASA      2218
      J3=J3+1                                                           NASA      2219
      IF (J3.GT. IDB(3)) GO TO 760                                      NASA      2220
      GO TO 400                                                         NASA      2221
  440 CONTINUE                                                          NASA      2222
C NON UNIFIED TRANSMITTER                                               NASA      2223
  450 CONTINUE                                                          NASA      2224
      IF (BITRAT(KXMTR)/1000.LE.DATAB(IT6,J3)) GO TO 460                NASA      2225
      J3=J3+1                                                           NASA      2226
      IF (J3.GT.IDB(3)) GO TO 760                                       NASA      2227
      GO TO 450                                                         NASA      2228
  460 IF (LINK.EQ.0) GO TO 470                                          010675      23
      IF (DATAB(IT5,J3) .EQ. 1.) GO TO 470                              NASA      2230
      J3=J3+1                                                           NASA      2231
      IF (J3 .GT. IDB(3)) GO TO 760                                     NASA      2232
      GO TO 440                                                         NASA      2233
C FREQUENCY,POWER,AND MODULATION COMPATIBILITY                          NASA      2234
  470 IF (FREQX(KXMTR).GE.DATAB(IT7,J3).AND.FREQX(KXMTR).LE.DATAB(IT8,J3 NASA      2235
     1)) GO TO 480                                                      NASA      2236
      J3=J3+1                                                           NASA      2237
      IF (J3 .GT. IDB(3)) GO TO 760                                     NASA      2238
      GO TO 390                                                         NASA      2239
  480 IF (PW(KXMTR) .LE. DATAB(IT9,J3)) GO TO 490                       021275      15
      J3=J3+1                                                           NASA      2241
      IF (J3 .GT. IDB(3)) GO TO 760                                     NASA      2242
      GO TO 390                                                         NASA      2243
C MODULATION  PHASE=1 ,FREQUENCY=2, AMPLITUDE=3                         NASA      2244
  490 IF (LINK.EQ.1) MODX(KXMTR) = 1                                    010675      24
      IF (MODX(KXMTR).EQ.0) GO TO 500                                   NASA      2246
      IF (MODX(KXMTR).EQ.DATAB(IT10,J3)) GO TO 500                      NASA      2247
      J3=J3+1                                                           NASA      2248
      IF (J3.GT.IDB(3)) GO TO 760                                       NASA      2249
      GO TO 390                                                         NASA      2250
  500 GO TO 690                                                         NASA      2251
  510 CONTINUE                                                          NASA      2252
C                                                                       NASA      2253
C RECEIVING ANTENNA SELECTION ****************************************** NASA      2254
      IC=6                                                              NASA      2255
      IF (F1 .EQ. 1.) GO TO 690                                         NASA      2256
      IF (SEO .NE. 1) GO TO 520                                         021075      11
      IF (SSS.EQ.0) GO TO 530                                           NASA      2258
  520 IF (DATAB(IA1,J7).EQ.11) GO TO 690                                NASA      2259
      J7=J7+1                                                           NASA      2260
      IF (J7.GT.IDB(2)) GO TO 760                                       NASA      2261
      GO TO 520                                                         NASA      2262
  530 IF (NADIR.EQ.0) GO TO 550                                         NASA      2263
  540 IF (DATAB(IA1,J7).EQ.41) GO TO 690                                NASA      2264
      J7=J7+1                                                           NASA      2265
      IF (J7.GT.IDB(2)) GO TO 760                                       NASA      2266
      GO TO 540                                                         NASA      2267
  550 IF (GRP.EQ.0) GO TO 540                                           NASA      2268
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  560   IF (DATAB(IA1,J7).EQ.51) GO TO 690                                   NASA      2269
        J7=J7+1                                                               NASA      2270
        IF (J7.GT.IDB(2)) GO TO 760                                          NASA      2271
        GO TO 560                                                             NASA      2272
C END RECEIVER ANTENNA SELECTION                                               NASA      2273
C RECEIVER SELECTION ***************************************************      NASA      2274
  570   IC=7                                                                  NASA      2275
        IERR=10                                                               NASA      2276
        IF (LINK.EQ.0) GO TO 770                                              010675      25
        IERR=0                                                                NASA      2278
  580   IF (DATAB(IR1,J4).EQ.1) GO TO 590                                    NASA      2279
        J4=J4+1                                                               NASA      2280
        IF (J4.GT.IDB(4)) GO TO 760                                          NASA      2281
        GO TO 580                                                             NASA      2282
  590   IF (DATAB(IR2,J4).GE.COMRAT) GO TO 690                               NASA      2283
        J4=J4+1                                                               NASA      2284
        IF (J4.GT.IDB(4)) GO TO 760                                          NASA      2285
        GO TO 580                                                             NASA      2286
  600   IC=8                                                                  NASA      2287
C COMMAND SIGNAL CONCITIONER ******************************************      NASA      2288
C  RECEIVER CONSTRAINT TESTED                                                 NASA      2289
  610   IF (DATAB(IR3,J4).EQ.0) GO TO 630                                    NASA      2290
  620   IF (DATAB(IR3,J4).EQ.DATAB(1,J5)) GO TO 640                          NASA      2291
        J5=J5+1                                                               NASA      2292
        IF (J5.GT.IDB(5)) GO TO 760                                          NASA      2293
        GO TO 620                                                             NASA      2294
  630   IF (DATAB(IC1,J5).EQ.0) GO TO 640                                    NASA      2295
        J5=J5+1                                                               NASA      2296
        IF (J5.GT.IDB(5)) GO TO 760                                          NASA      2297
        GO TO 630                                                             NASA      2298
C LINK SGLS OR USB                                                            NASA      2299
  640   IERR=10                                                               NASA      2300
        IF (LINK.EQ.0) GO TO 770                                              010675      26
        IERR=0                                                                NASA      2302
        IF (DATAB(IC2,J5).EQ.1) GO TO 650                                    NASA      2303
        J5=J5+1                                                               NASA      2304
        IF (J5.GT.IDB(5)) GO TO 760                                          NASA      2305
        GO TO 610                                                             NASA      2306
C COMMAND RATE                                                                NASA      2307
  650   IF (DATAB(IC3,J5).GE.DATAB(IR2,J4)) GO TO 690                        NASA      2308
        J5=J5+1                                                               NASA      2309
        IF (J5.GT.IDB(J5)) GO TO 760                                         NASA      2310
        GO TO 610                                                             NASA      2311
C                                                                             NASA      2312
C DIPLEXER SELECTION ***************************************************      NASA      2313
  660   IC=9                                                                  NASA      2314
        IF (F1 .EQ. 0.) GO TO 690                                             NASA      2315
C LINK SGLS OR USB                                                            NASA      2316
        IERR=10                                                               NASA      2317
        IF (LINK.EQ.0) GO TO 770                                              010675      27
        IERR=0                                                                NASA      2319
  670   IF (DATAB(ID1,J6).EQ.1) GO TO 680                                    NASA      2320
        J6=J6+1                                                               NASA      2321
        IF (J6.GT.IDB(6)) GO TO 760                                          NASA      2322
        GO TO 670                                                             NASA      2323
C DIPLEXER POWER                                                              NASA      2324
  680   JT=KPIC(4)                                                            NASA      2325
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      IF (DATAB(ID2,J6).GE.DATAB(IT9,JT)) GO TO 690                     NASA      2326
      J6=J6+1                                                           NASA      2327
      IF (J6.GT.ID8(6)) GO TO 760                                       NASA      2328
      GO TO 670                                                         NASA      2329
C                                                                       NASA      2330
C  PROGRAM CONTROL AND BOOK KEEPING  ********************************** NASA      2331
C    J1-BASEBAND ASSEMBLY UNIT                                          NASA      2332
C    J2-TRANSMITTER ANTENNAS                                            NASA      2333
C    J3-TRANSMITTER                                                     NASA      2334
C    J4-RECEIVER                                                        NASA      2335
C    J5-SIGNAL CONDITIONER                                              NASA      2336
C    J6-DIPLEXER                                                        NASA      2337
C        J7-RECEIVER ANTENNA                                            NASA      2338
  690 IF (IC.EQ.2 .OR. IC.EQ. 3) KPIC(IC)=J2                            NASA      2339
      IF (IC.EQ.4.OR.IC.EQ.5) KPIC(IC)=J3                               NASA      2340
      KONT = 0                                                          NASA      2341
      IN=KPIC(IC)                                                       NASA      2342
      IF (IN.NE.0) KCHOSE(IC)=DATAB(1,IN)                               NASA      2343
      WRITE (6,2000) IN,KCHOSE(IC),IC                                   NASA      2344
 2000 FORMAT (4H 690,3I10)                                              NASA      2345
700   CONTINUE                                                          NASA      2346
      IF (IC.EQ.9.AND.ITER.NE.0) GO TO 740                              NASA      2347
      IF (IC .EQ. 9 .AND. IPIC(4) .EQ. 0) GO TO 740                     NASA      2348
      IF (IC.EQ.9) GO TO 710                                            NASA      2349
      IF (INX .EQ. 1 .AND. (IC.EQ.2.OR.IC.EQ.4)) IC=IC+1                NASA      2350
      IF (ISPFLG(2).EQ.1 .AND. ITER.EQ.0) IC=IC+1                       021375       5
      ICX=IC+1                                                          NASA      2351
      GO TO (30,90,100,260,270,510,570,600,660),ICX                     NASA      2352
710   ICK=10-IC                                                         NASA      2353
      DO 730 I=ICK,9                                                    NASA      2354
      II=10-I                                                           NASA      2355
      IC=II-1                                                           NASA      2356
      IF (KCHOSE(II).EQ.0) GO TO 720                                    NASA      2357
      IF (KPIC(II)+1.GT.LIMPIC(II)) GO TO 720                           NASA      2358
      KPIC(II)=KPIC(II)+1                                               NASA      2359
      IN = KPIC(II)                                                     020775       1
      KCHOSE(II) = DATAB(1,IN)                                          020775       2
      GO TO 740                                                         NASA      2360
  720 IF (KPIC(II) .EQ. 0) GO TO 725                                    NASA      2361
      KPIC(II)=RESET(II)                                                NASA      2362
  725 IF (II .EQ.1) KCHOSE(1)=-1                                        NASA      2363
730   CONTINUE                                                          NASA      2364
740   DO 750 I=1,9                                                      NASA      2365
750   IPIC(I)=KPIC(I)                                                   NASA      2366
      IF (KONT.EQ.1.AND.KCHOSE(1).NE.-1.) GO TO 700                     NASA      2367
      IF (ITER.NE.0) GO TO 752                                          NASA      2368
      DO 751 I=1,9                                                      NASA      2369
      IF (KCHOSE(I).EQ.0) GO TO 751                                     NASA      2370
      NCHOSE(I) = 1                                                     NASA      2371
  751 CONTINUE                                                          NASA      2372
  752 CONTINUE                                                          NASA      2373
C                                                                       NASA      2374
C                                                                       NASA      2375
      J=0                                                               NASA      2376
      DO 753 I=1,9                                                      NASA      2377
      IF (KCHOSE(I).EQ.0) GO TO 753                                     NASA      2378
      J=J+1                                                             NASA      2379
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      ICHOSE(J)=KCHOSE(I)
  753 CONTINUE
      ICONV=J+1
  754 IF (J.EQ.11) GO TO 755
      J=J+1
      ICHOSE(J)=0
      GO TO 754
  755 CONTINUE
      ICHOSE(ICONV)=0
      ICHOSE(ICONV+1)=0
      IDB6=IDB(6)
      DO 780 I=1,9
      DO 780 J=1,IDB6
      IF (DATAB(1,J) .NE. ICHOSE(I)) GO TO 780
      IF (DATAB(22,J) .EQ. 0.) GO TO 780
      IF (ICHOSE(ICONV) .EQ. DATAB(22,J) .OR. ICHOSE(ICONV+1) .EQ.
     * DATAB(22,J)) GO TO 780
      IF (ICHOSE(ICONV) .NE. 0) GO TO 781
      ICHOSE(ICONV)=DATAB(22,J)
      GO TO 780
  781 ICHOSE(ICONV+1)=DATAB(22,J)
  780 CONTINUE
          IDB7=IDB(7)
       DO 757 I=1,11
          DO 756 J=1,IDB7
C
          IF (DATAB(1,J).NE. ICHOSE(I)) GO TO 756
          IF (I .GE. ICONV) CONVWT=CONVWT+DATAB(23,J)*NCHOSE(I)
              WT = WT + DATAB(23,J)*NCHOSE(I)
              VOL = VOL + DATAB(24,J)*NCHOSE(I)
              PL = PL + DATAB(16,J)*NCHOSE(I)
              PLMIN = PLMIN + DATAB(18,J)*NCHOSE(I)
              GO TO 757
C
  756 CONTINUE
C
  757 CONTINUE
      WRITE (6,3000) ICHOSE
 3000 FORMAT (4H 757,11I10)
      RETURN
760   CONTINUE
      IF (IC.EQ.2.OR.IC.EQ.3) KPIC(IC)=J2
      IF (IC.EQ.4.OR.IC.EQ.5) KPIC(IC)=J3
      KONT=1
      GO TO 710
770   CONTINUE
      WRITE (6,4000) KCHOSE
 4000 FORMAT(4H 770,11I10)
      ICHOSE(1)=-1
      RETURN
      END
```

REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 61

```
                SUBROUTINE BESS (X,BESJ,NMAX)                        NASA    2431
                DIMENSION BESJ(1), TJ(200)                           NASA    2432
                EULER=0.5772156649015329                             NASA    2433
                PI=2.0/3.14159265358979 3                            NASA    2434
 5              NU22=20                                              NASA    2435
                IF (10.-X) 10,10,20                                  NASA    2436
          10    HATN=(1.05)*X+25.                                    NASA    2437
                GO TO 30                                             NASA    2438
          20    HATN=35./(3.5-ALOG(X))                               NASA    2439
10        30    NU=HATN                                              NASA    2440
                TJ(NU+2)=0.0                                         NASA    2441
                TJ(NU+1)=0.000001                                    NASA    2442
                DO 40  J=1,NU                                        NASA    2443
                K=NU+1-J                                             NASA    2444
15              FK=K+K                                               NASA    2445
          40    TJ(K)=FK*TJ(K+1)/X-TJ(K+2)                           NASA    2446
                SUM=0.0                                              NASA    2447
                DO 50  J=3,NU,2                                      NASA    2448
          50    SUM=SUM+TJ(J)                                        NASA    2449
20              SUM=SUM+SUM                                          NASA    2450
                TK=1./(TJ(1)+SUM)                                    NASA    2451
                N=IABS(NMAX)+1                                       NASA    2452
                DO 60  J=1,N                                         NASA    2453
          60    BESJ(J)=TK*TJ(J)                                     NASA    2454
25              RETURN                                               NASA    2455
                END                                                  NASA    2456
```

SUMMARY OF CHANGES MADE BY THE OPTIMIZER
13 WORDS OF INVARIANT RLIST REMOVED FROM THE LOOP BEGINNING AT LINE 13

```
      INTEGER FUNCTIONRESET(K)                                          NASA   2457
      COMMON /DBCOM/DATAB(55,100),IDB(30)                               022575  367
C                                                                       022575  368
      IF (K .EQ.1) RESET=1                                              NASA   2459
      IF (K.EQ.2.OR.K.EQ.3.OR.K.EQ.6) RESET=IDB(1)+1                    NASA   2460
      IF (K.EQ.4.OR.K.EQ.5) RESET = IDB(2) + 1                          NASA   2461
      IF (K.EQ.7.OR.K.EQ.8.OR.K.EQ.9) RESET = IDB(K-4) + 1              NASA   2462
      RETURN                                                            NASA   2463
      END                                                               NASA   2464
```

```
          SUBROUTINE SKED(NEQUIP,NCCNF)                                      NASA      2465
          COMMON /USER8/SKDME(7,3)                                           022575     369
C                                                                            022575     370
          COMMON /CHOSE/    COST(5,60),      DPIA(11,60),     ICHOSE(60),    022575     371
         1                  NCHOSE(60),      REL ( 6,60), DBSKED(7,60),      022575     372
         2                  THM(4,60)                                        022575     373
C                                                                            022575     374
          COMMON/PRTCOM/    ACCRCY,        AM,        AN,        BF,        BS,  022575     375
         1            CDPI(7,2),    CISTAR,      CTOT,      DOTE,        DE,  022575     376
         2                DRIWT,    EQBSTR,    FEEINV,    FEEOPS,      FEER,  022575     377
         3                  GSE,      IREL,    ITRUNC,    MMDOLD,NAME(3,60),  022575     378
         4                  OPS,    PAYINV,    PAYQUL,      PAYR,        PE,  022575     379
         5                  PMP,       PMR,  POWER(6),        PU,   PWR(60),  022575     380
         6                  QCP,       QCR,  ROLD(60),    SABMWT,    SATADP,  022575     381
         7               SATINV,      SATR,      SEIP,      SEIR,  TSAVE(6),  022575     382
         8             SSREL(6),   SUBE(7),   SUBT(7),  SUBUE(7),  SUBUP(7),  022575     383
         9                   TA,  TAU(6,6),        TB,        TC,        TE,  022575     384
         A                   TF,     TOOLR,     TOOLU,    TOTOPS,     TRUNC,  022575     385
         B                   TS,       TTT, VOLUME(6),   VQL(60), WEIGHT(6),  022575     386
         C               XLTOT,      XMEH,    XMEINV,      XMEL,     XMEVL,  022575     387
         D                 XMEW,     XMEWT,     XVEST                        022575     388
          DIMENSION CONF(22,5),TSUB(6),ICI(5),NEQUIP(5),NCONF(6)             NASA      2474
          DATA ICI/0,5,8,10,15/                                              NASA      2475
          DATA CONF/1.,1.5,1.,2.,1.5,3*1.,2.,12*1.,2.,                        NASA      2476
         * 6.,9.,6.,12.,9.,5.,6.,8.,4.,6*2.,6*4.,2.,                          NASA      2477
         * 22*7.,22*2.E-7,5*.0001,3*.0002,13*.00007,.0002/                    NASA      2478
          FK=1.                                                              NASA      2479
C          CONF ROWS ARE 1 TO 5 FOR S AND C                                  NASA      2480
C                        6 TO 8 FOR AUXPRO                                   NASA      2481
C                        9 TO 10 FOR DPI                                     NASA      2482
C                         11 TO 15 FOR COMM                                  NASA      2483
C                         16 TO 21 FOR EP                                    NASA      2484
C                         22 FOR M E                                         NASA      2485
          DO 1 J=1,6                                                         NASA      2486
          TAU(6,J) = 0.0                                                     111874      41
        1 TSAVE(J)=0.                                                        NASA      2487
          DO 4 IS=1,5                                                        NASA      2488
          IF (IS .EQ. 1) ISTRT=1                                             NASA      2489
          IF (IS .GT. 1) ISTRT=IEND+1                                        NASA      2490
          IF (IS .EQ. 1) IEND=NEQUIF(1)                                      NASA      2491
          IF (IS .GT. 1) IEND=IEND+NEQUIP(IS)                                NASA      2492
          TSUB(1)=0.                                                         NASA      2493
          TSUB(2)=0.                                                         NASA      2494
          C=0.                                                               NASA      2495
          NUM=0                                                              NASA      2496
          DO 2  J=ISTRT,IEND                                                 NASA      2497
          TCD=DBSKED(3,J)+DBSKED(4,J)                                        NASA      2498
          IF (TCD .GT. TSUB(1)) TSUB(1)=TCD                                  NASA      2499
          TCQ=DBSKED(5,J)+DBSKED(6,J)                                        NASA      2500
          IF (TCQ .GT. TSUB(2)) TSUB(2)=TCQ                                  NASA      2501
          C=C+(1.335*DBSKED(1,J)+1.41*DBSKED(2,J))*1000.                     NASA      2502
        2 NUM=NUM+NCHOSE(J)                                                  NASA      2503
          XNUM=NUM                                                           NASA      2504
          REDUN=XNUM/NEQUIP(IS)                                              NASA      2505
```

```
      IC=ICI(IS)+NCONF(IS)                                              NASA      2506
      R=REDUN**.125                                                     NASA      2507
      TSUB(3)=CONF(IC,2)+CONF(IC,5)*R*CONF(IC,1)*C**.6667               NASA      2508
      TSUB(4)=CONF(IC,3)+CONF(IC,4)*R*C                                 NASA      2509
      TSDQ=TSUB(2)                                                      NASA      2510
      IF(TSUB(2) .LT. TSUB(3)+TSUB(4))TSDQ=TSUB(3)+TSUB(4)              NASA      2511
      TSUB(5)=CONF(IC,1)*FK*TSUB(3)                                     NASA      2512
      TSUB(6)=TSUB(1)+TSDQ                                              NASA      2513
      DO 10 J=1,6                                                       111874      42
   10 TAU(IS,J)=TSUB(J)                                                 111874      43
      IF (TSUB(5) .LT. TSAVE(5)) TSUB(5)=TSAVE(5)                       NASA      2514
      IF (TSUB(5) .GE. TSAVE(5))TSAVE(5)=TSUB(5)                        NASA      2515
      IF (TSUB(6) .LE. TSAVE(6)) GO TO 4                                NASA      2516
      DO 3 J=1,6                                                        NASA      2517
    3 TSAVE(J)=TSUB(J)                                                  NASA      2518
      ISSAVE=IS                                                         NASA      2519
    4 CONTINUE                                                          NASA      2520
C      NOW DO MISSION EQUIP                                             NASA      2521
      DO 5 J=1,3                                                        NASA      2522
      DO 5 I=1,7                                                        NASA      2523
      JJ=4-J                                                            NASA      2524
      IF (SKDME(I,JJ) .GT. 0.) GO TO 6                                  NASA      2525
    5 CONTINUE                                                          NASA      2526
      JJ=0                                                              NASA      2527
    6 IF (JJ .EQ. 0) GO TO 20                                           NASA      2528
      TSUB(1)=0.                                                        NASA      2529
      TSUB(2)=0.                                                        NASA      2530
      C=0.                                                              NASA      2531
      DO 8 J=1,JJ                                                       NASA      2532
      TCD=SKDME(3,J)+SKDME(4,J)                                         NASA      2533
      IF (TCD. GT. TSUB(1)) TSUB(1)=TCD                                 NASA      2534
      TCQ=SKDME(5,J)+SKDME(6,J)                                         NASA      2535
      IF (TCQ .GT. TSUB(2)) TSUB(2)=TCQ                                 NASA      2536
    8 C=C+(1.335*SKDME(1,J)+1.41*SKDME(2,J))*1000.                      NASA      2537
      TSUB(3)=CONF(22,2)+CONF(22,5)*CONF(22,1)*C**.6667                 NASA      2538
      TSUB(4)=CONF(22,3)+CONF(22,4)*C                                   NASA      2539
      TSDQ=TSUB(2)                                                      NASA      2540
      IF (TSUB(2) .LT. TSUB(3)+TSUB(4))TSDQ=TSUB(3)+TSUB(4)             NASA      2541
      TSUB(5)=CONF(22,1)*FK*TSUB(3)                                     NASA      2542
      TSUB(6)=TSUB(1)+TSDQ                                              NASA      2543
      DO 11 J=1,6                                                       111874      44
   11 TAU(6,J) =TSUB(J)                                                 111874      45
      IF (TSUB(5) .LT. TSAVE(5)) TSUB(5)=TSAVE(5)                       NASA      2544
      IF (TSUB(5) .GE. TSAVE(5))TSAVE(5)=TSUB(5)                        NASA      2545
      IF (TSUB(6) .LT. TSAVE(6)) GO TO 20                               NASA      2546
      DO 9 J=1,6                                                        NASA      2547
    9 TSAVE(J)=TSUB(J)                                                  NASA      2548
   20 TSAVE(6)=TSAVE(6)+TSAVE(5)                                        NASA      2549
      RETURN                                                            NASA      2550
      END                                                               NASA      2551
```

```
      SUBROUTINE SANDC(IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)                NASA      2552
C        ICHOSE(10) IS SELECTED EQUIP AS FOUR CIGIT EQUIP = -- MANF =     NASA      2553
C        NCONF IS CONFIGURATION NUMBER,ITER IS NUMBER OF THIS ITERATION   NASA      2554
C        IERR IS A MULTIPLE MESSAGE ERROR FLAG,IPIC IS THE LAST           NASA      2555
C        SET OF SUBSCRIPTS CHOSEN                                         NASA      2556
C        COMMON USER LISTS USER INPUT PARAMETERS                          NASA      2557
C        COMMON BTWN LISTS NECESSARY COMMUNICATION BETWEEN SUBROUTINES    NASA      2558
C        COMMON CDATA HAS LAST SUBSCRIFT FOR EACH PIECE OF EQUIP,AND      NASA      2559
C        THE NECESSARY PIECE OF THE DATA BASE                             NASA      2560
      DIMENSION  ICHOSE(9),IPIC(3),ES(6),C(5),DMA(2),G(3),F(9),NCHOSE(9)  NASA      2561
      DIMENSION NCONF(6)                                                  NASA      2562
      COMMON /USER1/     ALPHA,       AX,        AY,        AZ,      OPHI,022575     389
     1                      EA,     EANT,       EP1,         K,      MANV,022575     390
     2                   OMEGR,   PDOTAV,    PDOTRX,    PDOTRY,    PDOTRZ,022575     391
     3                  PDOTST,    PDOTX,     PDOTY,     PDOTZ,     PDOTO,022575     392
     4                  PHIFOV,    PHIRX,     PHIRY,     PHIRZ,    TACCEL,022575     393
     5                  THETMX,    THOLD,        TL,     TPMIN,    TSMALL,022575     394
     6                      XN,      XNN,      XNNN,       XNU,        YN,022575     395
     7                      ZN                                            022575     396
C                                                                         022575     397
      COMMON /USERI/    APOGEE,   COMRAT,    DIAMAX, EEQWT(9),       EPME,022575     398
     1                  EQM1WT,   EQM1XL,    EQM1YL,    EQM1ZL,    EQM2WT,022575     399
     2                  EQM2XL,   EQM2YL,    EQM2ZL,        FE,    IAGNCY,022575     400
     3          IDEBUG,   ISAT,   MB12SH,    OPTEMP,    ORBINC,    PERIGE,022575     401
     4          MICRO,   RELME,  SPEC(6),     SPEC1,         T,    XCGSA1,022575     402
     5                    XMER,     XMEU                                  022575     403
C                                                                         022575     404
      COMMON /BTWN/      ACSSN,    ACSWP,       ALT,      AREA,    BATCAP,022575     405
     1               BITRAT(2),    CLIFE,    CONVWT,         D,        DT,022575     406
     2                      DX,       DY,        DZ,     EQBLG,    EQBSID,022575     407
     3                      FC,       FF,    HARNWT,       HPT,    HTPIPE,022575     408
     4                    HTPT,   HTRPRB,    HTRPWR,               IBTLOC,022575     409
     5                   LMBDD,       NC,     OMEGS,    PASSTR,        PJ,022575     410
     6                      PL,    PLMIN,    POCNWT,      RADA,    RADAB,022575     411
     7                     RAT,       RJ,    SABOLG,     SATLG,    SATTWT,022575     412
     8                   SATWT,   SATXCG,    SATYCG,    SATZCG,    SA1XL,022575     413
     9                   SA1YL,    SA1ZL,      SIDE,    SYSLB,    THCMWT,022575     414
     A               THRUST(2),       TI,     TNKWT,     TPRIM,        VB,022575     415
     B                    VCHP,      VOL,      WATE,        WB,       WBT,022575     416
     C                      WT,       XJ,    XNZERO,        YJ,        ZJ 022575     417
C                                                                         022575     418
      COMMON /DBCOM/DATA8(55,100),IDB(30)                                 022575     419
C                                                                         022575     420
      DATA XMD,YMD,ZMD,DI,XMD2,YMD2,ZMC2/3*.0003,.03,3*.04/                NASA      2574
      ACSSN=2.                                                            NASA      2575
      IF (NCONF(1) .EQ. 1) GO TO 10                                       NASA      2576
      DT=DT/12.                                                           NASA      2577
      D=D/12.                                                             NASA      2578
      DX=DX/12.                                                           NASA      2579
      DY=DY/12.                                                           NASA      2580
      CZ=DZ/12.                                                           NASA      2581
      XJ=XJ/4636.8                                                        NASA      2582
      YJ=YJ/4636.8                                                        NASA      2583
      ZJ=ZJ/4636.8                                                        NASA      2584
```

```
      RJ=1.                                                   NASA     2585
      CONVWT=0.                                               NASA     2586
   10 RJ=RJ/4636.8                                            NASA     2587
      PJ = PJ / 4636.8                                        010675     30
      WT=0.                                                   NASA     2588
      VOL=0.                                                  NASA     2589
      PL=0.                                                   NASA     2590
      FLMIN=0.                                                NASA     2591
      DB = 0.4 * PHIRX                                        010375      2
      IF (DB .LT. 0.05) DB = 0.05                             010375      3
      ETA = 0.85                                              012075      1
      EPSLN = 0.7                                             010375      4
      EPSA  = 0.2                                             010375      5
      OMEGO = 1.1864E8 / (20.920E6 + 6076.*ALT)**1.5          010375      7
      RE = 3441.66                                            011275     33
      OMEGE = 7.2927E-5                                       010375      9
      HO = 9.4E-8                                             010375     10
      XK = 3*OMEGO*OMEGO /(57.3)**2                           010375     11
      XCG = 1./12. * (SATXCG-500.-.5*EQBLG)                   011075      5
      YCG = 1./12. * SATYCG                                   011075      6
      ZCG = 1./12. * SATZCG                                   011075      7
      A = .5 * (2. * RE + APOGEE + PERIGE)                    011275     34
      EQBLG = EQBLG / 12.                                     011275     35
      IF (NCONF(6) .EQ. 2) EQBSID = EQBSID/12.                011275     36
      SA1XL = SA1XL / 12.                                     011275     37
      SA1YL = SA1YL / 12.                                     011275     38
      SA1ZL = SA1ZL / 12.                                     011275     39
      ICONF = NCONF(6)                                        010375     15
      GO TO (11,12,13),ICONF                                  010375     16
   11 SIDE = D                                                010375     17
      XLNTH= EQBLG                                            010375     18
      GO TO 14                                                010375     19
   12 SIDE = EQBSID                                           010375     20
      XLNTH= EQBLG                                            010375     21
      GO TO 14                                                010375     22
   13 SIDE = D                                                010375     23
      XLNTH= D                                                010375     24
   14 CONTINUE                                                010375     25
      IF (EQM1WT .GT. 0.) GO TO 15                            010375     26
      EQM1XL = 0.                                             010375     27
      EQM1YL = 0.                                             010375     28
      EQM1ZL = 0.                                             010375     29
   15 IF (EQM2WT .GT. 0.) GO TO 16                            010375     30
      EQM2XL = 0.                                             010375     31
      EQM2YL = 0.                                             010375     32
      EQM2ZL = 0.                                             010375     33
   16 CONTINUE                                                010375     34
      ICONF = NCONF(1)                                        010375     35
      GO TO (17,18,19,19,19),ICONF                            010375     36
   17 INOSE = 1                                               010375     37
      TEMPIN = XJ                                             011075      8
      XJ = YJ                                                 011075      9
      YJ = TEMPIN                                             011075     10
      GO TO 20                                                010375     38
   18 INOSE = 2                                               010375     39
      TEMPIN = XJ                                             011075     11
      XJ = ZJ                                                 011075     12
```

```
      ZJ = TEMPIN                                          011075   13
      GO TO 20                                             010375   40
   19 INOSE = 3                                            010375   41
C     NO TRANSPOSITION REQUIRED                            011075   14
   20 CONTINUE                                             010375   42
      TGX = XK * (ZJ-YJ) * PHIRX / 57.3                    011075   15
      TGY = XK * (ZJ-XJ) * PHIRY / 57.3                    011075   16
      TGZ = 0.                                             011075   17
      ICONF = NCONF(5)                                     010375   43
      GO TO (21,26,21,26,21,26),ICONF                      010375   44
   21 SREFSP = SA1XL * SA1YL                               010375   45
      I = XCGSA1                                           010375   46
      GO TO (22,23,24),I                                   010375   47
   22 XREFSP = .5 * XLNTH                                  010375   48
      GO TO 25                                             010375   49
   23 XREFSP = 0.0                                         010375   50
      GO TO 25                                             010375   51
   24 XREFSP =-.5 * XLNTH                                  010375   52
   25 CONTINUE                                             011075   18
      DELXSP = 2. * (XCG-XREFSP)                           010375   56
      DELYSP = 2. * YCG                                    010375   57
      DELZSP = 2. * ZCG                                    010375   58
      GO TO 27                                             010375   59
   26 SREFSP = 0.                                          010375   60
      DELXSP = 0.                                          011275   40
      DELYSP = 0.                                          011275   41
      DELZSP = 0.                                          011275   42
   27 IF (PERIGE .LT. 65.) GO TO 28                        010375   62
      IF (PERIGE .GT. 500.) GO TO 29                       010375   63
      TSX = 0.                                             010375   64
      TSY = 0.                                             010375   65
      TSZ = 0.                                             010375   66
      TAUXS = 0.0                                          011575    5
      TAUYS = 0.0                                          011575    6
      TAUZS = 0.0                                          011575    7
      GO TO 40                                             010375   67
   28 IERR = -1                                            010375   68
      ICHOSE(1) = -1                                       010375   69
      RETURN                                               010375   70
   29 TAX = 0.                                             010375   71
      TAY = 0.                                             010375   72
      TAZ = 0.                                             010375   73
      TAUXA = 0.0                                          011575    8
      TAUYA = 0.0                                          011575    9
      TAUZA = 0.0                                          011575   10
      AP=(SIDE*XLNTH)+(EQM1XL*EQM1YL/144.)+(EQM2XL*EQM2YL/144.)  011275   43
      XCP =(EQM1XL-EQM2XL)/24.                             011275   44
      YCP= 0.0                                             010375   76
      SIDE12 = SIDE*12.                                    011275   45
      ZCP = AMAX1(SIDE12,EQM1ZL,EQM2ZL) /(-24.)            011275   46
      XLX= XCG - XCP                                       010375   78
      XLY= YCG - YCP                                       010375   79
      XLZ= ZCG - ZCP                                       010375   80
      R = RE/A                                             011275   47
      S = 1.02 * ASIN(R)                                   011275   48
      TS = 2. * (3.14159-S)/OMEGO                          010375   83
      GO TO (30,31,32),INOSE                               010375   84
```

```
   30 TEMPX = XLX                                                      010375    85
      XLX = XLY                                                        010375    86
      XLY = -TEMPX                                                     011275    49
      TSX = HO * AP * (1.+EPSLN) * XLY                                 010375    88
      TSY = HO * AP * (1.+EPSLN) *(-XLX)                               010375    89
      TSZ = 0.                                                         010375    90
      GO TO 38                                                         010375    91
   31 TEMPX = XLX                                                      010375    92
      XLX = -XLZ                                                       010375    93
      XLZ = TEMPX                                                      010375    94
      TSX = 0.                                                         010375    95
      TSY = HO * AP * (1.+EPSLN) * XLZ                                 010375    96
      TSZ = HO * AP * (1.+EPSLN) *(-XLY)                               010375    97
      GO TO 38                                                         010375    98
   32 TSX = HO *(AP*(1.+EPSLN)*XLY + SREFSP*(1.+EPSA)*DELYSP)          011275    50
      TSY = HO *(AP*(1.+EPSLN)*XLX + SREFSP*(1.+EPSA)*DELXSP)          011275    51
      TSZ = 0.                                                         010375   101
   38 TAUXS = TS                                                       011275    52
      TAUYS = TS                                                       011275    53
      TAUZS = TS                                                       011275    54
      GO TO 60                                                         010375   105
C                                 COMPUTE SOLAR TORQUES                010375   106
   40 WEDWO = OMEGE / OMEGO                                            011275    55
      SININC = SIN(ORBINC)                                             010375   109
      BETA = ATAN(WEDWO*SININC) + DB                                   010375   110
      ALFA = DB                                                        010375   111
      ALFBAR=ACOS(COS(BETA)/(SQRT(1.+ COS(BETA)**2 * TAN(ALFA)**2)))   010375   112
      CA = 2.012 * COS(ALFBAR)**2                                      010375   113
      CY = - SIN(2.*BETA)                                              010375   114
      CN = SIN (2.*ALFA)                                               010375   115
      IF (PERIGE .GE.300.) GO TO 42                                    010375   116
      IF (PERIGE .GE.100.) GO TO 41                                    010375   117
      RHO = 1.5E-9 * .02**((PERIGE-65.)/35.)                           010375   118
      GO TO 43                                                         010375   119
   41 RHO = 3.E-11 * 4.333E-4**((PERIGE-100.)/200.)                    010375   120
      GO TO 43                                                         010375   121
   42 RHO = 1.3E-14 * 1.538E-2**((PERIGE-300.)/200.)                   010375   122
   43 Q = 3.6E10 * (RHO/A)                                             010375   123
      GO TO (44,46,48),INOSE                                           010375   124
   44 SREF = SIDE*XLNTH + EQM1XL*EQM1ZL/144. + EQM2XL*EQM2ZL/144.      011275    56
      XREF = (EQM1XL-EQM2XL) / 24.                                     011275    57
      SIDE12 = SIDE * 12.                                              011275    58
      YREF = AMAX1 (SIDE12,EQM1YL,EQM2YL) / 24.                        011275    59
      ZREF = 0.                                                        010375   128
      DELTX = XCG - XREF                                               010375   129
      DELTY = YCG - YREF                                               010375   130
      DELTZ = ZCG - ZREF                                               010375   131
      TEMPX = DELTX                                                    010375   132
      DELTX = DELTY                                                    010375   133
      DELTY = -TEMPX                                                   010375   134
      GO TO 50                                                         010375   135
C                                                                      010375   136
   46 SREF = SIDE*XLNTH + EQM1XL*EQM1YL/144. + EQM2XL*EQM2YL/144.      011275    60
      XREF = (EQM1XL-EQM2XL) / 24.                                     011275    61
      YREF = 0.                                                        010375   139
      SIDE12 = SIDE * 12.                                              011275    62
      ZREF = AMAX1 (SIDE12,EQM1ZL,EQM2ZL) /(-24.)                      011275    63
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```
      DELTX = XCG - XREF                                                010375     141
      DELTY = YCG - YREF                                                010375     142
      DELTZ = ZCG - ZREF                                                010375     143
      TEMPX = DELTX                                                     010375     144
      DELTX = -DELTZ                                                    010375     145
      DELTZ = TEMPX                                                     010375     146
      GO TO 50                                                          010375     147
C                                                                       010375     148
   48 SIDE12 = SIDE * 12.                                               011275      64
      SREF=AMAX1(SIDE12,EQM1YL,EQM2YL)*AMAX1(SIDE12,EQM1ZL,EQM2ZL)/144. 011275      65
      XREF = XLNTH/2. + EQM1XL/12.                                      011275      66
      YREF = 0.                                                         010375     151
      ZREF = 0.                                                         010375     152
      DELTX = XCG - XREF                                                010375     153
      DELTY = YCG - YREF                                                010375     154
      DELTZ = ZCG - ZREF                                                010375     155
C                                                                       010375     156
   50 TAX =Q*SREF*(DELTZ*CY+DELTY*CN)+Q*SREFSP*(DELZSP*CY+DELYSP*CN)    010375     157
      TAY =Q*SREF*(DELTZ*CA-DELTX*CN)+Q*SREFSP*(DELZSP*CA-DELXSP*CN)    010375     158
      TAZ =Q*SREF*(-DELTY*CA-DELTX*CY)+Q*SREFSP*(-DELYSP*CA-DELXSP*CY)  010375     159
      P = 17.8 /(APOGEE-PERIGE+18.75) +0.05                             010375     160
      TAUXA = P * T * 2.592E6                                           011275      67
      TAUYA = P * T * 2.592E6                                           011275      68
      TAUZA = P * T * 2.592E6                                           011275      69
C                                                                       010375     164
   60 TAX = ABS (TAX)                                                   011775       2
      TAY = ABS (TAY)                                                   011775       3
      TAZ = ABS (TAZ)                                                   011775       4
      TGX = ABS (TGX)                                                   011775       5
      TGY = ABS (TGY)                                                   011775       6
      TGZ = ABS (TGZ)                                                   011775       7
      TSX = ABS (TSX)                                                   011775       8
      TSY = ABS (TSY)                                                   011775       9
      TSZ = ABS (TSZ)                                                   011775      10
C                                                                       011775      11
      XMD = TAX + TGX + TSX                                             011775      12
      YMD= TAY + TGY + TSY                                              010375     166
      ZMD= TAZ + TGZ + TSZ                                              010375     167
      PRINT 9002,TAX,TAY,TAZ,TAUXA,TAUYA,TAUZA                          011575      11
 9002 FORMAT (1X,5HTAX= E11.4,5HTAY= E11.4,5HTAZ= E11.4,7HTAUXA= E11.4, 011575      12
     *       7HTAUYA= E11.4,7HTAUZA= E11.4)                             011575      13
      PRINT 9003,TSX,TSY,TSZ,TAUXS,TAUYS,TAUZS                          011575      14
 9003 FORMAT (1X,5HTSX= E11.4,5HTSY= E11.4,5HTSZ= E11.4,7HTAUXS= E11.4, 011575      15
     *       7HTAUYS= E11.4,7HTAUZS= E11.4)                             011575      16
      PRINT 9004,TGX,TGY,TGZ                                            011575      17
 9004 FORMAT (1X,5HTGX= E11.4,5HTGY= E11.4,5HTGZ= E11.4)                011575      18
      IF (NCONF(1) .EQ. 2) GO TO 200                                    NASA      2592
      IF (NCONF(1) .EQ. 3) GO TO 300                                    NASA      2593
      IF (NCONF(1) .EQ. 4) GO TO 400                                    NASA      2594
      IF (NCONF(1) .EQ. 5)  GO TO 500                                   NASA      2595
C       INITIALIZE FOR DUAL SPIN                                        NASA      2596
      IERR=0                                                            NASA      2597
      IF (ITER .GT. 0 ) DX=DX/12.                                       NASA      2598
      DO 100 I=1,7                                                      NASA      2599
      II=IDB(I)                                                         NASA      2600
      IF (ITER .EQ. 0) NCHOSE(I)=1                                      NASA      2601
      WT=WT+DATAB(23,II)*NCHOSE(I)                                      NASA      2602
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```
      VOL=VOL+DATAB(24,II)*NCHOSE(I)                                    NASA      2603
      PL=PL+DATAB(16,II)*NCHOSE(I)                                      NASA      2604
      PLMIN=PLMIN+DATAB(18,II)*NCHOSE(I)                                NASA      2605
      TEMPIN = XJ                                                       010675      31
      XJ = YJ                                                           010675      32
      YJ = TEMPIN - PJ                                                  010675      33
  100 ICHOSE(I)=DATAB(1,II)                                             NASA      2606
      IF (ITER .EQ. 0) NCHOSE(8) =1                                     NASA      2607
      IF (ITER .EQ. 0) NCHOSE(9)=1                                      NASA      2608
      IF (ITER .EQ. 0) NCHOSE(7)=2                                      NASA      2609
      I14=IDB(13)+1                                                     NASA      2610
      ICHOSE(9)=DATAB(1,I14)                                            NASA      2611
      II=IDB(6)                                                         NASA      2612
      CONVWT=DATAB(23,I14)*NCHOSE(9)                                    NASA      2613
      WT=WT+DATAB(23,I14)*NCHOSE(9)                                     NASA      2614
      VOL=VOL+DATAB(24,I14)*NCHOSE(9)                                   NASA      2615
      PL=PL+DATAB(16,I14)*NCHOSE(9)                                     NASA      2616
      PLMIN=PLMIN+DATAB(18,I14)*NCHOSE(9)                               NASA      2617
      IF (IPIC(1) .NE. 0) J1=IPIC(1)+1                                  NASA      2618
      IF (ITER .GT. 0) J1=IPIC(1)                                       NASA      2619
      IF (IPIC(1) .EQ. 0) J1=IDB(7) +1                                  NASA      2620
      IF (J1 .GT. IDB(8) ) GO TO 118                                    NASA      2621
      J1E=IDB(8)                                                        NASA      2622
C      ES(6) CORRES EARTH SENSORS,C(5) CORRES CONTROL TIMING            NASA      2623
C      DMA(2) CORRES DESPIN MECH ASMB,G(3) CORRES GIMBAL,               NASA      2624
C      GH CORRES GIMBAL ANGLE                                           NASA      2625
      IF (ITER .GT. 0) GO TO 112                                        NASA      2626
  103 DO 104 I=1,6                                                      NASA      2627
  104 ES(I)=DATAB(I+5,J1)                                               NASA      2628
      II=IDB(1)                                                         NASA      2629
      DO 106 I=1,2                                                      NASA      2630
  106 DMA(I)=DATAB(I+6,II)                                              NASA      2631
       II=IDB(6)                                                        NASA      2632
      DO 108 I=1,5                                                      NASA      2633
  108 C(I)=DATAB(I+5,II)                                                NASA      2634
      II=IDB(7)                                                         NASA      2635
      DO 110 I=1,3                                                      NASA      2636
  110 G(I)=DATAB(I+5,II)                                                NASA      2637
      II=IDB(5)                                                         NASA      2638
      GH=DATAB(6,II)                                                    NASA      2639
  112 XM1=.116*(320.*60.*XNN)/(21.*RJ*OMEGR)                            NASA      2640
      XM2=.03*(360.*60.*XNN)/(21.*RJ*OMEGR)                             NASA      2641
      XK2=SQRT((XNN*ES(2)/21.)**2+(XNN*ES(6)/21.)**2+(XNN*DMA(2)/21.)**2 NASA      2642
     *+XM2*XM2)                                                         NASA      2643
      XK1=SQRT((ES(1)/2.94)**2+(ES(3)/2.94)**2+C(4)**2+C(5)**2+         NASA      2644
     *(75.*DMA(1)/PJ)**2+(.75/PJ)**2)                                   NASA      2645
      EZ=XM1+XK2                                                        NASA      2646
      IF (K.EQ.1) GO TO 114                                             NASA      2647
      EY=SQRT(ES(4)**2+ES(5)**2)+XK1                                    NASA      2648
      EX=EZ                                                             NASA      2649
      GO TO 116                                                         NASA      2650
  114 GT=G(1)*G(1)+G(2)*G(2)+G(3)*G(3)                                  NASA      2651
      EY=SQRT(ES(4)**2+ES(5)**2)+SQRT(XK1**2+GT+C(1)**2+GH*GH)          NASA      2652
      EX=SQRT(XM1**2+ES(4)**2)+SQRT(XK2**2+C(1)**2+C(2)**2+C(3)**2      NASA      2653
     *+GH*GH+GT)                                                        NASA      2654
  116 IF (EX .LE. PHIRX .AND. EY .LE. PHIRY .AND. EZ .LE. PHIRZ)        NASA      2655
     * GO TO 120                                                        NASA      2656
```

```
      J1=J1+1                                                           NASA    2657
      FRINT 9000,RJ,PJ                                                  011475    20
 9000 FORMAT(1X,4HRJ= E11.4,4HPJ= E11.4)                                011475    21
      FRINT 9001,EX,EY,EZ                                               011475    22
 9001 FORMAT (1X,4HEX= E11.4,4HEY= E11.4,4HEZ= E11.4)                   011475    23
      IF (J1 .LE. J1E) GO TO 103                                        NASA    2658
C     LAST ONE CHECKED AND NONE FOUND                                   NASA    2659
  118 ICHOSE(8)=-1                                                      NASA    2660
      RETURN                                                            NASA    2661
C       ACCEPTABLE DEVICE SELECTED                                      NASA    2662
  120 IPIC(1)=J1                                                        NASA    2663
      PRINT 9000,RJ,PJ                                                  011475    24
      FRINT 9001,EX,EY,EZ                                               011475    25
      IPIC(2)=0                                                         NASA    2664
      ICHOSE(8)=DATAB(1,J1)                                             NASA    2665
      WT=WT+DATAB(23,J1)*NCHOSE(8)                                      NASA    2666
      VOL=VOL+DATAB(24,J1)*NCHOSE(8)                                    NASA    2667
      FL=PL+DATAB(16,J1)*NCHOSE(8)                                      NASA    2668
      FLMIN=PLMIN+DATAB(18,J1)*NCHOSE(8)                                NASA    2669
      TI=267.*TPRIM+FE*TSMALL                                           NASA    2670
      FF=2.5                                                            NASA    2671
      FC = 14.1E-9 * FF * DX * DI / (RJ*PHIRX)                          011275    70
      CLIFE = 37.E6 * TPRIM * FF * DX * DI / (RJ*PHIRX)                 011275    71
      RETURN                                                            NASA    2673
C       YAW SPIN CONFIG                                                 NASA    2674
C       INITIALIZE SKIPPING SOME IF ITERATING                           NASA    2675
  200 IERR=0                                                            NASA    2676
      TEMPIN = XJ                                                       010675    34
      XJ = ZJ                                                           010675    35
      ZJ = TEMPIN                                                       010675    36
      I1=IDB(8)+1                                                       NASA    2680
      ICHOSE(1)=DATAB(1,I1)                                             NASA    2681
      I2=IDB(9)+1                                                       NASA    2682
      I3=IDB(10)+1                                                      NASA    2683
      ICHOSE(2)=DATAB(1,I2)                                             NASA    2684
      ICHOSE(3)=DATAB(1,I3)                                             NASA    2685
      I14=IDB(13)+1                                                     NASA    2686
      ICHOSE(6)=DATAB(1,I14)                                            NASA    2687
      I7=IDB(2)                                                         NASA    2688
      ICHOSE(7)=DATAB(1,I7)                                             NASA    2689
      IF (ITER .GT. 0) GO TO 203                                        NASA    2690
      DO 202 I=1,9                                                      NASA    2691
  202 NCHOSE(I)=1                                                       NASA    2692
  203 WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)+NCHOSE(3)*    NASA    2693
     * DATAB(23,I3)+NCHOSE(6)*DATAB(23,I14)+NCHOSE(7)*DATAB(23,I7)      NASA    2694
      CONVWT=DATAB(23,I14)*NCHOSE(6)                                    NASA    2695
      VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)+NCHOSE(3)*  NASA    2696
     * DATAB(24,I3)+NCHOSE(6)*DATAB(24,I14)+NCHOSE(7)*DATAB(24,I7)      NASA    2697
      PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)+NCHOSE(3)*    NASA    2698
     * DATAB(16,I3)+NCHOSE(6)*DATAB(16,I14)+NCHOSE(7)*DATAB(16,I7)      NASA    2699
      FLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)+        NASA    2700
     * NCHOSE(3)*DATAB(18,I3)+NCHOSE(6)*DATAB(18,I14)+NCHOSE(7)*        NASA    2701
     * DATAB(18,I7)                                                     NASA    2702
      ICHOSE(8)=0                                                       NASA    2703
      ICHOSE(9)=0                                                       NASA    2704
C       IERR=1 : MAX ALLOWABLE SYSTEM ERROR UNACCEPTABLE                NASA    2705
      IF (PHIRX .LT. .125) IERR=1                                       NASA    2706
```

```
      DB=PHIRX*.4                                                       NASA  2707
      IF (DB .LT. .05) DB=.05                                           NASA  2708
C      CALCULATE F VALUES                                               NASA  2709
       F(1)=(DPHI*DT/57.3+.04*D)*FE/DY                                  NASA  2710
       F(2)=(DPHI*DT/57.3+.04*D)*FE/DZ                                  NASA  2711
       F(3)=2.*.04*D*DPHI/57.3*FE/DX                                    NASA  2712
       F(4)=XMD/DX                                                      NASA  2713
       F(5)=YMD/DY                                                      NASA  2714
       FMIN=AMAX1(F(1),F(2),F(3),F(4),F(5))                             NASA  2715
      FMAX=(PDOTRX*XJ)/(2.*DI*DX)                                       NASA  2716
C      IERR 1X : MAX RATE ERROR TOO SMALL                               NASA  2717
      IF (FMAX .LT. 2.*FMIN) IERR=IERR+10                               NASA  2718
      FF=2.*FMIN                                                        NASA  2719
      IF (FMAX .LT. FF) FF=FMIN                                         NASA  2720
      TDM=AMAX1(XMD,YMD)                                                NASA  2721
      E=540.*TDM/(DX*FF)+.12-DB                                         NASA  2722
      IF ( E .LT. 0.) E=0.                                              NASA  2723
C      SELECT EARTH SENSOR WITH PHIX<=PHIRX                             NASA  2724
      IF (IPIC(1) .GT. 0) GO TO 204                                     NASA  2725
      J1=IDB(11)+1                                                      NASA  2726
      GO TO 206                                                         NASA  2727
  204 J1=IPIC(1)                                                        NASA  2728
      IF (IPIC(2).GE.IDB(13) .AND. ITER.EQ.0) GO TO 211                 012475   1
  206 J1E=IDB(12)                                                       NASA  2729
      E1=DATAB(6,J1)                                                    NASA  2730
      II=IDB(10)                                                        NASA  2731
      PHIX=SQRT(DATAB(7,J1)**2+DATAB(8,J1)**2)+DB+DATAB(11,II)+E        NASA  2732
      IF (DATAB(6,J1) .GT. DB) GO TO 211                                NASA  2733
      IF (PHIX .GT. PHIRX) GO TO 211                                    NASA  2734
      ICHOSE(4)=DATAB(1,J1)                                             NASA  2735
      IPIC(1)=J1                                                        NASA  2736
C      EARTH SENSOR SET                                                 NASA  2737
      GO TO 212                                                         NASA  2738
  211 J1=J1+1                                                           NASA  2739
      IPIC(2)=0                                                         NASA  2740
      IF (J1 .LE. J1E) GO TO 206                                        NASA  2741
C      MINUS ONE FLAG FOR NOT FOUND                                     NASA  2742
      ICHOSE(4)=-1                                                      NASA  2743
      ICHOSE(5)=0                                                       NASA  2744
      RETURN                                                            NASA  2745
C      HERE WHEN ACCEPTABLE EARTH SENSOR FOUND                          NASA  2746
  212 H=ZJ * OMEGS                                                      NASA  2747
C      SELECT REACTION WHEEL WITH MOMENTUM GRTR THAN H                  NASA  2748
      J2=IPIC(2)                                                        NASA  2749
      IF (J2 .GE. IDB(13) .AND. ITER .EQ. 0) IPIC(2)=0                  NASA  2750
      IF (IPIC(2) .EQ. 0) J2=IDB(12)+1                                  NASA  2751
      IF (ITER .EQ. 0 .AND. IPIC(2) .NE. 0) J2=J2+1                     NASA  2752
      J2E=IDB(13)                                                       NASA  2753
  214 H1=DATAB(6,J2)                                                    NASA  2754
      IF ( H1 .GT. H) GO TO 218                                         NASA  2755
      J2=J2+1                                                           NASA  2756
      IF ( J2 .LE. J2E) GO TO 214                                       NASA  2757
      IPIC(2)=0                                                         NASA  2758
      GO TO 211                                                         NASA  2759
C      ACCEPTABLE COMBINATION FOUND                                     NASA  2760
  218 ICHOSE(5)=DATAB(1,J2)                                             NASA  2761
      IPIC(2)=J2                                                        NASA  2762
```

```
      WT=WT+DATAB(23,J2)*NCHOSE(5)+DATAB(23,J1)*NCHOSE(4)               NASA      2763
      VOL=VOL+DATAB(24,J2)*NCHOSE(5)+DATAB(24,J1)*NCHOSE(4)             NASA      2764
      PL=PL+DATAB(16,J2)*NCHCSE(5)+DATAB(16,J1)*NCHOSE(4)               NASA      2765
      PLMIN=PLMIN+DATAB(18,J2)*NCHOSE(5)+DATAB(18,J1)*NCHOSE(4)         NASA      2766
      XI=37000000.*TPRIM*DX*(FF*DI)**2/(XJ*.4*PHIRX)                    NASA      2767
     *+2./57.3*.04*D*DPHI*FE*TSMALL/DX                                  NASA      2768
     *+XNU*XJ*PDOT0/(57.3*DX)                                           NASA      2769
     *+2.*XJ*PDOTX*XN/(57.3*DX)                                         NASA      2770
     * +     (TAX*TAUXA + 2.592E6*TGX*T + TSX*TAUXS) / DX               011775      13
      YI=37000000.*TPRIM*DY*(FF*DI)**2/(YJ*.4*PHIRY)                    NASA      2772
     *+(DPHI/57.3*DT+.04*D)*FE*TSMALL/DY                                NASA      2773
     *+XNU*YJ*PDOT0/(57.3*DY)                                           NASA      2774
     *+2.*YJ*PDOTY*YN/(57.3*DY)                                         NASA      2775
     * +     (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS) / DY               011775      14
      ZI=(DPHI/57.3*DT+.04*D)*FE*TSMALL/DZ                              NASA      2777
     *+XNU*ZJ*PDOT0/(57.3*DZ)                                           NASA      2778
     *+2.*ZJ*PDOTZ*ZN/(57.3*DZ)                                         NASA      2779
      TI=XI+YI+ZI+FE*TSMALL                                             NASA      2780
      FC=14.1E-9*FF*DX*DI/(XJ*.4*PHIRX)                                 NASA      2781
      CLIFE = 37.E6 * TPRIM * FF * DX * DI / (XJ*.4*PHIRX)              011275      72
      RETURN                                                            NASA      2782
C       3-AXIS M CONFIG                                                 NASA      2783
C         CHOSEN AS:                                                    NASA      2784
C           ATTITUDE REF                                                NASA      2785
C           VALVE                                                       NASA      2786
C           ASC                                                         NASA      2787
C           GYROS                                                       NASA      2788
C           EARTH SENSOR                                                NASA      2789
C       INITIALIZE                                                      NASA      2790
  300 IERR=0                                                            NASA      2791
      I1=IDB(14)+1                                                      NASA      2792
      I2=IDB(15)+1                                                      NASA      2793
      ICHOSE(1)=DATAB(1,I1)                                             NASA      2794
      ICHOSE(2)=DATAB(1,I2)                                             NASA      2795
      I14=IDB(13)+1                                                     NASA      2796
      ICHOSE(3)=DATAB(1,I14)                                            NASA      2797
      IF (ITER .GT. 0) GO TO 303                                        NASA      2798
      DO 302 I=1,9                                                      NASA      2799
  302 NCHOSE(I)=1                                                       NASA      2800
  303 WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)+DATAB(24,I14)* NASA     2801
     * NCHOSE(3)                                                        NASA      2802
      CONVWT=DATAB(23,I1)*NCHOSE(1)                                     NASA      2803
      VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)+            NASA      2804
     * NCHOSE(3)*DATAB(24,I14)                                          NASA      2805
      PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)+NCHOSE(3)*    NASA      2806
     * DATAB(16,I14)                                                    NASA      2807
      PLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)+        NASA      2808
     * NCHOSE(3)*DATAB(18,I14)                                          NASA      2809
      DO 301 I=6,9                                                      NASA      2810
  301 ICHOSE(I)=0                                                       NASA      2811
C       CALCULATE F VALUES                                              NASA      2813
      F(1)=(DPHI*DT/57.3+.04*D)*FE/DY                                   NASA      2814
       F(2)=(DPHI*DT/57.3+.04*D)*FE/DZ                                  NASA      2815
       F(3)=2.*.04*D*DPHI/57.3*FE/DX                                    NASA      2816
      F(4)=XMD/DX                                                       NASA      2817
       F(5)=YMD/DY                                                      NASA      2818
       F(6)=ZMD/DZ                                                      NASA      2819
```

```
      FMIN=AMAX1(F(1),F(2),F(3),F(4),F(5),F(6))
      F(7)=PDOTRX*XJ/(DI*DX)
      F(8)=PDOTRY*YJ/(DI*DY)
      F(9)=PDOTRZ*ZJ/(DI*DZ)
      FMAX=AMAX1(F(7),F(8),F(9))
      IERR=0
C       IERR 1X : MAX RATE ERROR TOO SMALL
      IF (FMAX .LT. 2.*FMIN) IERR=IERR+10
      FF=2.*FMIN
      IF (FMAX .LT. FF) FF=FMIN
      DBX=.4*PHIRX
      DBY=.4*PHIRY
      DBZ=.4*PHIRZ
      IF (DBX .LT. .05) DBX=.05
      IF (DBY .LT. .05) DBY=.05
      IF (DBZ .LT. .05) DBZ=.05
      DDBX=.1*DBX
      DDBY=.1*DBY
      DDBZ=.1*DBZ
      R1=.2*PDOTRX
      R2=.2*PDOTRY
      R3=.2*PDOTRZ
      R=AMAX1(R1,R2,R3)
C       SELECT 3 GYROS
      IF (IPIC(1) .GT. 0) GO TO 304
      J1=IDB(16)+1
      GO TO 306
  304 J1=IPIC(1)
      IF (IPIC(2).GE.IDB(18) .AND. ITER.EQ.0) GO TO 308             012475    2
  306 J1E=IDB(17)
      GTEST=DATAB(6,J1)
      IF (GTEST .GT. R) GO TO 308
      ICHOSE(4)=DATAB(1,J1)
      IPIC(1)=J1
C        GYRO SET
      I1=IDB(14)+1
      G1=DATAB(8,I1)/(DATAB(11,I1)+OMEGO)
      G2=(DATAB(8,I1)*DATAB(10,I1)-DATAB(7,I1)*(DATAB(11,I1)+OMEGO))
     * /(OMEGO*(DATAB(11,I1)+OMEGO))
      G3=DATAB(10,I1)/(OMEGO*(DATAB(11,I1)+OMEGO))
      GO TO 310
  308 J1=J1+1
      IPIC(2)=0
      IF (J1 .LE. J1E) GO TO 306
C       MINUS ONE FLAG FOR NOT FOUND
      ICHOSE(4)=-1
      ICHOSE(5)=0
      RETURN
C       SELECT EARTH SENSOR
  310 J2=IPIC(2)
      IF(J2 .GE. IDB(18) .AND.  ITER .EQ. 0) IPIC(2)=0
      IF (IPIC(2) .EQ. 0) J2=IDB(17)+1
      IF (ITER .EQ. C .AND. IPIC(2) .NE. 0) J2=J2+1
      J2E=IDB(18)
  314 PPHIN=DATAB(6,J2)*DATAB(6,J2)*DATAB(6,I1)/DATAB(13,J2)*
     * ATAN(DATAB(13,J2)/DATAB(9,I1))
      FOMEN=DATAB(6,J2)*DATAB(6,J2)/DATAB(13,J2)*.026
```

```
      E=SQRT(DATAB(7,J2)**2+DATAB(11,J2)**2)+SQRT(DATAB(9,J2)**2          NASA      2876
     * +DATAB(10,J2)**2)                                                  NASA      2877
      EY=DBY+SQRT(PPHIN+(DATAB(12,J2)*DATAB(6,I1)/DATAB(9,I1))**2         NASA      2878
     *+(E*DATAB(6,I1)/DATAB(9,I1))**2+AY*AY+(EP1/DATAB(9,I1))**2          NASA      2879
     *+DDBY*DDBY)                                                         NASA      2880
      EX=DBX+SQRT(POMEN+(DATAB(12,J2)*G1)**2+E*E*G1*G1+AX*AX+DDBX*DDBX)   NASA      2881
      EZ=DBZ+SQRT((DATAB(7,J1)*OMEGO*G3)**2+(DATAB(6,J1)*G3)**2           NASA      2882
     * +DATAB(7,J1)**2+(DATAB(6,J1)/OMEGO)**2+AZ*AZ+(DATAB(12,J2)         NASA      2883
     * *G2)**2+DDBZ*DDBZ)                                                 NASA      2884
      IF (EX .LT. PHIRX .AND. EY .LT. PHIRY .AND. EZ .LT. PHIRZ)          NASA      2885
     * GO TO 318                                                          NASA      2886
      J2=J2+1                                                             NASA      2887
      IF ( J2 .LE. J2E) GO TO 314                                         NASA      2888
      IPIC(2)=0                                                           NASA      2889
      GO TO 308                                                           NASA      2890
C      ACCEPTABLE COMBINATION FOUND                                       NASA      2891
  318 ICHOSE(5)=DATAB(1,J2)                                               NASA      2892
      IPIC(2)=J2                                                          NASA      2893
      WT=WT+DATAB(23,J2)*NCHOSE(5)+DATAB(23,J1)*NCHOSE(4)                 NASA      2894
      VOL=VOL+DATAB(24,J2)*NCHOSE(5)+DATAB(24,J1)*NCHOSE(4)               NASA      2895
      PL=PL+DATAB(16,J2)*NCHOSE(5)+DATAB(16,J1)*NCHOSE(4)                 NASA      2896
      PLMIN=PLMIN+DATAB(18,J2)*NCHOSE(5)+DATAB(18,J1)*NCHOSE(4)           NASA      2897
      XI=37000000.*TPRIM*DX*(FF*DI)**2/(XJ*DBX)                           NASA      2898
     *+2./57.3*.04*D*DPHI*FE*TSMALL/DX                                    NASA      2899
     *+XNU*XJ*PDOTO/(57.3*DX)                                             NASA      2900
     *+2.*XJ*PDOTX*XN/(57.3*DX)                                           NASA      2901
     * +      (TAX*TAUXA + 2.592E6*TGX*T + TSX*TAUXS) / DX                011775      15
      YI=37000000.*TPRIM*DY*(FF*DI)**2/(YJ*DBY)                           NASA      2903
     *+(DPHI/57.3*DT+.04*D)*FE*TSMALL/DY                                  NASA      2904
     *+XNU*YJ*PDOTO/(57.3*DY)                                             NASA      2905
     *+2.*YJ*PDOTY*YN/(57.3*DY)                                           NASA      2906
     * +      (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS) / DY                011775      16
      ZI=37000000.*TPRIM*DZ*(FF*DI)**2/(ZJ*DBZ)                           NASA      2908
     *+(DPHI/57.3*DT+.04*D)*FE*TSMALL/DZ                                  NASA      2909
     *+XNU*ZJ*PDOTO/(57.3*DZ)                                             NASA      2910
     *+2.*ZJ*PDOTZ*ZN/(57.3*DZ)                                           NASA      2911
     * +      (TAZ*TAUZA + 2.592E6*TGZ*T + TSZ*TAUZS) / DZ                011775      17
      TI=XI+YI+ZI+FE*TSMALL                                               NASA      2913
      FC=14.1E-9*FF*DX*DI/(XJ*.4*PHIRX)                                   NASA      2914
      CLIFE = 37.E6 * TPRIM * FF * DX * DI / (XJ*.4*PHIRX)                011275      73
      RETURN                                                              NASA      2915
C      CONFIGURATION 4                                                    NASA      2916
  400 IERR=0                                                              NASA      2917
      QJ1=XJ*PDOTX/57.3                                                   NASA      2918
      QJ2=YJ*PDOTY/57.3                                                   NASA      2919
      QJ3=ZJ*PDOTZ/57.3                                                   NASA      2920
      HMAN=AMAX1(QJ1,QJ2,QJ3)                                             NASA      2921
      TMD=AMAX1(XMD2,YMD2,ZMD2)                                           NASA      2922
      HREQ=HMAN+86400.*TL*TMD                                             NASA      2923
      TREQ=HMAN/TACCEL+TMD                                                NASA      2924
C      TEST IF ONLY 3-AXIS WHEELS OKAY                                    NASA      2925
      PDOTM=AMAX1(PDOTX,PDOTY,PDOTZ)                                      NASA      2926
      PDOTRM=AMIN1(PDOTRX,PDOTRY,PDOTRZ)                                  NASA      2927
      IF (TREQ/HREQ .GE. .02 .AND. .000833*PDOTM .LT. PDOTRM) GO TO 403   NASA      2928
      DO 402 I=1,9                                                        NASA      2929
  402 ICHOSE(I)=-1                                                        NASA      2930
C      TEST IF 3-AXIS ACCEPTABLE                                          NASA      2931
```

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C         IERR : 1XX MEANS 3-AXIS WHEELS ACCEPTABLE                            NASA      2932
  403   IF (TREQ/HREQ .LT. .1) IERR=100                                        NASA      2933
C         IERR : 1XXX MEANS DOUBLE GIMBAL CMG+S ACCEPTABLE                     NASA      2934
        IF (TACCEL .LT. 20.) IERR=IERR+1000                                    NASA      2935
        HL=HMAN+TMD*TL                                                         NASA      2936
        HS=AMIN1(QJ1,QJ2,QJ3)                                                  NASA      2937
        HS=HS+TMD*TL                                                           NASA      2938
C         SET FIXED EQUIPMENT: ELECTRONICS PROCESSOR,VALVE DRIVER,             NASA      2939
C         SENSOR(SUN OR HORIZON)                                               NASA      2940
        I1=IDB(18)+1                                                           NASA      2941
        I2=IDB(15)+1                                                           NASA      2942
        IF (ISAT .EQ. 1) I3=IDB(17)+1                                          NASA      2943
        IF (ISAT .GT. 1) I3=IDB(8)+1                                           NASA      2944
        ICHOSE(1)=DATAB(1,I1)                                                  NASA      2945
        ICHOSE(2)=DATAB(1,I2)                                                  NASA      2946
        ICHOSE(3)=DATAB(1,I3)                                                  NASA      2947
        ICHOSE(7)=0                                                            NASA      2948
        ICHOSE(8)=0                                                            NASA      2949
        ICHOSE(9)=0                                                            NASA      2950
        IF (ITER .GT. 0) GO TO 407                                             NASA      2951
        DO 405 I=1,9                                                           NASA      2952
  405   NCHOSE(I)=1                                                            NASA      2953
  407   WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)+DATAB(23,I3)       NASA      2954
       **NCHOSE(3)                                                             NASA      2955
        VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)+DATAB(24,I3)     NASA      2956
       **NCHOSE(3)                                                             NASA      2957
        PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)+DATAB(16,I3)       NASA      2958
       **NCHOSE(3)                                                             NASA      2959
        PLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)+             NASA      2960
       * DATAB(18,I3)*NCHOSE(3)                                                NASA      2961
C         SELECT CMG                                                           NASA      2962
        GAMMA=ATAN(HS*(XNNN-2.)/(HL*XNNN))                                     NASA      2963
        H=HS/(XNNN*SIN(GAMMA))                                                 NASA      2964
        IF (IPIC(1) .GT. 0) J1=IPIC(1)                                         NASA      2965
        IF (IPIC(1) .EQ. 0) J1=IDB(19)+1                                       NASA      2966
        IF (IPIC(2).GE.IDB(17).AND.IPIC(3).GE.IDB(21).AND.ITER.EQ.0)           012475       3
       *                                                  GO TO 440            012475       4
C         RETURNS HERE TO TEST NEW CMG                                         NASA      2967
  410   IF (DATAB(6,J1) .LT. H) GO TO 414                                      NASA      2968
        SDOTM=2.*H/(TACCEL*DATAB(6,J1))                                        NASA      2969
        TMAX=DATAB(6,J1)*PDOTM/57.3                                            NASA      2970
        IF (SDOTM .LE. DATAB(7,J1) .AND. TMAX .LE. DATAB(8,J1))GO TO 417       NASA      2971
  414   J1=J1+1                                                                NASA      2972
        IF (J1 .LE. IDB(20)) GO TO 410                                         NASA      2973
        ICHOSE(4)=-1                                                           NASA      2974
        ICHOSE(5)=0                                                            NASA      2975
        ICHOSE(6)=0                                                            NASA      2976
        RETURN                                                                 NASA      2977
C         CMG SELECTED                                                         NASA      2978
  417   ICHOSE(4)=DATAB(1,J1)                                                  NASA      2979
        NCHOSE(4)=XNNN                                                         NASA      2980
        XKK=DATAB(7,J1)*PDOTM/57.3                                             NASA      2981
        W=-32.+(.068+.29*XKK)*(DATAB(6,J1)+960.)                               NASA      2982
        P=(.0103+.0235*XKK)*(DATAB(6,J1)+1430.)                                NASA      2983
        V=7.45+(.00265-.0062*XKK)*(DATAB(6,J1)-1720.)                          NASA      2984
        DATAB(23,J1)=W                                                         NASA      2985
        DATAB(24,J1)=V                                                         NASA      2986
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      DATAB(18,J1)=P                                                    NASA    2987
C      GYRO NEXT                                                        NASA    2988
      IF (IPIC(2) .GT. 0) J2=IPIC(2)                                    NASA    2989
      IF (IPIC(2) .EQ. 0) J2=IDB(16)+1                                  NASA    2990
      IF (IPIC(3).GE.IDB(21) .AND. ITER.EQ.0) GO TO 440                 012775    23
  420 ICHOSE(5)=DATAB(1,J2)                                             NASA    2991
C      SELECT STAR SENSOR                                               NASA    2992
      PHIR=AMIN1(PHIRX,PHIRY,PHIRZ)                                     NASA    2993
      TSMAX=.3*PHIR                                                     NASA    2994
      J3=IPIC(3)                                                        NASA    2995
      IF (J3 .GE. IDB(21) .AND. ITER .EQ. 0) IPIC(3)=0                  NASA    2996
      IF (IPIC(3) .EQ. 0) J3=IDB(20)+1                                  NASA    2997
      IF (ITER .EQ. 0 .AND. IPIC(3) .NE. 0) J3=J3+1                     NASA    2998
  422 IF (DATAB(6,J3) .GT. 1. .AND. PDOTST .GT. 2.) GO TO 440           NASA    2999
      IF (DATAB(6,J3) .EQ. 2. .AND. PHIFOV .GT. 30.) GO TO 440          NASA    3000
      IF (DATAB(6,J3) .EQ. 1. .AND. PDOTAV .LE. .016) GO TO 440         NASA    3001
      IF (DATAB(6,J3) .EQ. 1. .AND. THOLD .GT. TSMAX) GO TO 440         NASA    3002
      IF (DATAB(6,J3) .GT. 1.) GO TO 424                                NASA    3003
      IF (DATAB(9,J3)*.451 .LT. 4.) GO TO 440                           NASA    3004
      XNM=ALOG10(-4.+.451*DATAB(9,J3))                                  NASA    3005
      TSC=57.3/(XNM*DATAB(8,J3)*PDOTM)                                  NASA    3006
      DPHIAV=PDOTM*TSC                                                  NASA    3007
      PHIEB=DATAB(6,J2)*TSC                                             NASA    3008
      PHIESF=DATAB(7,J2)*DPHIAV                                         NASA    3009
      PHIE=SQRT(DATAB(7,J3)**2+(.0000833*PDOTM)**2+PHIEB*PHIEB+         NASA    3010
     * PHIESF*PHIESF)                                                   NASA    3011
      GO TO 426                                                         NASA    3012
  424 PHIE=SQRT(DATAB(7,J3)**2+(.0000833*PDOTM)**2)                     NASA    3013
  426 IF (PHIE .LT. PHIR) GO TO 450                                     NASA    3014
  440 J3=J3+1                                                           NASA    3015
      IF (J3 .LE. IDB(21)) GO TO 422                                    NASA    3016
      IPIC(3)=0                                                         NASA    3017
      J3 = IDB(20) + 1                                                  012775    24
      J2=J2+1                                                           NASA    3018
      IF (J2 .LE. IDB(17)) GO TO 420                                    NASA    3019
      IPIC(2)=0                                                         NASA    3020
      J2=IDB(16)+1                                                      NASA    3021
      GO TO 414                                                         NASA    3022
C      ACCEPTABLE COMBINATION FOUND                                     NASA    3023
  450 ICHOSE(6)=DATAB(1,J3)                                             NASA    3024
      IPIC(1)=J1                                                        NASA    3025
      IPIC(2)=J2                                                        NASA    3026
      IPIC(3)=J3                                                        NASA    3027
      WT=WT+W*XNNN+NCHOSE(5)*DATAB(23,J2)+NCHOSE(6)*DATAB(23,J3)        NASA    3028
      VOL=VOL+V*XNNN+NCHOSE(5)*DATAB(24,J2)+NCHOSE(6)*DATAB(24,J3)      NASA    3029
      PL=PL+P*XNNN+NCHOSE(5)*DATAB(16,J2)+NCHOSE(6)*DATAB(16,J3)        NASA    3030
      PLMIN=PLMIN+DATAB(18,J1)*XNNN+NCHOSE(5)*DATAB(18,J2)+NCHOSE(6)*   NASA    3031
     * DATAB(18,J3)                                                     NASA    3032
C      NOW THRUST AND IMPULSE                                           NASA    3033
      F(1)=(DPHI*DT/57.3+.04*D)*FE/DY                                   NASA    3034
      F(2)=(DPHI*DT/57.3+.04*D)*FE/DZ                                   NASA    3035
      F(3)=2./57.3*.04*D*DPHI*FE/DX                                     NASA    3036
      FF=AMAX1(F(1),F(2),F(3))                                          NASA    3037
      TI=(F(1)+F(2)+F(3))*TSMALL                                        NASA    3038
     * +XNU*PDOT0/57.3*(XJ/DX+YJ/DY+ZJ/DZ)                              NASA    3039
     * +     (TAX*TAUXA + 2.592E6*TGX*T + TSX*TAUXS) / DX               011775    18
     * +     (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS) / DY               011775    19
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     * +      (TAZ*TAUZA + 2.592E6*TGZ*T + TSZ*TAUZS) / DZ                 011775      20
     * +FE*TSMALL                                                          NASA      3041
      FC=FF*DX*DI/(XJ*.4*PHIRX)*14.1E-9                                    NASA      3042
      CLIFE = 37.E6 * TPRIM * FF * DX * DI / (XJ*.4*PHIRX)                 011275      74
      RETURN                                                               NASA      3043
C      CONFIGURATION 5                                                     NASA      3044
C      SELECT FIXED EQUIPMENT                                              NASA      3045
  500 I1=IDB(15)+1                                                         NASA      3046
      I2=IDB(21)+1                                                         NASA      3047
      ICHOSE(1)=DATAB(1,I1)                                                NASA      3048
      ICHOSE(2)=DATAB(1,I2)                                                NASA      3049
      DO 502 I=5,9                                                         NASA      3051
  502 ICHOSE(I)=0                                                          NASA      3052
      IF (ITER .GT. 0) GO TO 505                                           NASA      3053
      DO 504 I=1,9                                                         NASA      3054
  504 NCHOSE(I)=1                                                          NASA      3055
  505 WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)                  NASA      3056
      VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)                NASA      3057
      PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)                  NASA      3058
      PLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)            NASA      3059
      IERR=0                                                               NASA      3060
      EBEAM=AMIN1(PHIRX,PHIRY)                                             NASA      3061
      DB=.4*EBEAM                                                          NASA      3062
      IF (DB .LT. .05) DB=.05                                              NASA      3063
      EAR=EBEAM*EBEAM-EA*EA                                                NASA      3064
      EHS=(EAR-(EANT*PHIRZ)**2)*.5                                         NASA      3065
      IF (EHS .LT. 0.) EHS=0.                                              NASA      3066
      EHS=SQRT(EHS)                                                        NASA      3067
      IF (IPIC(1) .GT. 0) J1=IPIC(1)                                       NASA      3068
      IF (IPIC(1) .EQ. 0) J1=IDB(17)+1                                     NASA      3069
      IF (IPIC(2).GE.IDB(13) .AND. ITER.EQ.0) GO TO 510                    012475       5
  508 E=SQRT(DATAB(6,J1)**2+DATAB(7,J1)**2+DATAB(8,J1)**2+                 NASA      3070
     * DATAB(11,J1)**2)+SQRT(DATAB(9,J1)**2+DATAB(10,J1)**2)               NASA      3071
      IF (E .LT. EHS) GO TO 512                                            NASA      3072
  510 J1=J1+1                                                              NASA      3073
      IF (J1 .LE. IDB(18)) GO TO 508                                       NASA      3074
      ICHOSE(3)=-1                                                         NASA      3075
      ICHOSE(4)=0                                                          NASA      3076
      RETURN                                                               NASA      3077
  512 J2=IPIC(2)                                                           NASA      3078
      IF (J2 .GE. IDB(13) .AND. ITER .EQ. 0) IPIC(2)=0                     NASA      3079
      IF (IPIC(2) .EQ. 0) J2=IDB(12)+1                                     NASA      3080
      IF (ITER .EQ. 0 .AND. IPIC(2) .GT. 0)J2=J2+1                         NASA      3081
  515 H=57.3*ZMO*ABS(EANT)/(OMEGO*SQRT(EAR-2.*E*E))                        NASA      3082
      IF (DATAB(6,J2) .GE. H) GO TO 520                                    NASA      3083
      J2=J2+1                                                              NASA      3084
      IF (J2 .LE. IDB(13)) GO TO 515                                       NASA      3085
      IPIC(2)=0                                                            NASA      3086
      GO TO 510                                                            NASA      3087
  520 ICHOSE(3)=DATAB(1,J1)                                                NASA      3088
      ICHOSE(4)=DATAB(1,J2)                                                NASA      3089
      IPIC(1)=J1                                                           NASA      3090
      IPIC(2)=J2                                                           NASA      3091
      IPIC(3)=0                                                            NASA      3092
      WT=WT+NCHOSE(3)*DATAB(23,J1)+NCHOSE(4)*DATAB(23,J2)                  NASA      3093
      VOL=VOL+NCHOSE(3)*DATAB(24,J1)+NCHOSE(4)*DATAB(24,J2)                NASA      3094
      PL=PL+NCHOSE(3)*DATAB(16,J1)+NCHOSE(4)*DATAB(16,J2)                  NASA      3095
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      FLMIN=PLMIN+NCHOSE(3)*DATAB(18,J1)+NCHOSE(4)*DATAB(18,J2)          NASA      3096
      DX = 0.5 * D * COS(ALPHA/57.3)                                     011775      21
      FMAX=DB*DATAB(6,J2)*SQRT(XJ/ZJ)/(DI*DX)                            NASA      3098
      DZ = 0.5 * D  * SIN(ALPHA/57.3)                                    011775      22
      DY=.5*D                                                            NASA      3100
      F(1)=(DPHI/57.3*DT+.04*D)*FE/DY                                    NASA      3101
      F(2)=(DPHI/57.3*DT+.04*D)*FE/DZ                                    NASA      3102
      F(3)=2./57.3*.04*D*DPHI*FE/DX                                      NASA      3103
      FMIN=AMAX1(F(1),F(2),F(3))                                         NASA      3104
      FF=2.*FMIN                                                         NASA      3105
      IF (FF .LT. FMIN) FF=FMIN                                          NASA      3106
      DELH = 2. * DATAB(6,J2) * (PHIRX/57.3) * TAN(ALPHA/57.3)           012075       2
     *          /COS(ALPHA/57.3)                                         012075       3
      TI =  (F(1)+F(2)+F(3))  * TSMALL                                   012075       5
     *    +  (TAX*TAUXA+2.592E6*TGX*T+TSX*TAUXS)/(ETA*DELH) *FF *DI      031575       1
     *    + XNU * PDOTO/57.3 * (XJ/DX + YJ/DY + ZJ/DZ)                   012075       7
     *    + (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS)/DY                   012075       8
     *    + FE * TSMALL                                                  012075       9
      CLIFE = (TI - FE * TSMALL) / (FF * DI * 3.0)                       031575       2
      FC = 1.3889E-12 * CLIFE /T                                         012075      10
      RETURN                                                             NASA      3113
      END                                                                NASA      3114
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      SUBROUTINE STRUCT(NCONF)                                          NASA       3115
      DIMENSION NCONF(6)                                                NASA       3116
      COMMON /USER9/      CA,       CE                                  022575      421
C                                                                       022575      422
      COMMON /USERI/   APOGEE,   COMRAT,   DIAMAX, EEQWT(9),    EPME,   022575      423
     1                 EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,  EQM2WT,   022575      424
     2                 EQM2XL,   EQM2YL,   EQM2ZL,       FE,  IAGNCY,   022575      425
     3       IDEBUG,   ISATOR,   MB12SH,   OPTEMP,   ORBINC,  PERIGE,   022575      426
     4        MICRO,    RELME,  SPEC(6),    SPEC1,    XDUM1,  XCGSA1,   022575      427
     5                   XMER,     XMEU                                 022575      428
C                                                                       022575      429
      COMMON /BTWN/     ACSSN,    ACSWP,      ALT,     AREA,  BATCAP,   022575      430
     1              BITRAT(2),    CLIFE,   CONVWT,   SATDAM,      DT,   022575      431
     2                     DX,       DY,       DZ,    EQBLG,  EQBSID,   022575      432
     3                     FC,       FF,   HARNWT,      HPT,  HTPIPE,   022575      433
     4                   HTPT,   HTRPRB,   HTRPWR,            IBTLOC,   022575      434
     5                  LMBDD,       NC,   OMEGS,   PASSTR,       PJ,   022575      435
     6                     PL,    PLMIN,   POCNWT,     RADA,   RADAB,   022575      436
     7                    RAT,       RJ,   SABOLG,    SATLG,  SATTHT,   022575      437
     8                  SATWT,   SATXCG,   SATYCG,   SATZCG,   SA1XL,   022575      438
     9                  SA1YL,    SA1ZL,     SIDE,   SYSLB,  THCMWT,   022575      439
     A              THRUST(2),       TI,   TNKWT,    TPRIM,      VB,   022575      440
     B                   VCHP,      VOL,   SOARWT,       WB,     WBT,   022575      441
     C                     WT,       XJ,   XNZERO,       YJ,      ZJ    022575      442
C                                                                       022575      443
      COMMON/PRTCOM/   ACCRCY,       AM,       AN,       BF,      BS,   022575      444
     1              CDPI(7,2),   CISTAR,     CTOT,     DDTE,      DE,   022575      445
     2                 ORIWT,    EQBSTR,   FEEINV,   FEEOPS,    FEER,   022575      446
     3                    GSE,     IREL,   ITRUNC,   MMDOLD,NAME(3,60),  022575     447
     4                    OPS,   PAYJNV,   PAYQUL,     PAYR,      PE,   022575      448
     5                    PMP,      PMR, POWER(6),       PU, PWR(60),   022575      449
     6                    QCP,      QCR, ROLD(60),   SABMWT,  SATADP,   022575      450
     7                 SATINV,     SATR,     SEIP,     SEIR, SKTAU(6),  022575      451
     8               SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7),  022575      452
     9                     TA, TAU(6,6),       TB,       TC,      TE,   022575      453
     A                     TF,    TOOLR,    TOOLU,   TOTOPS,   TRUNC,   022575      454
     B                     TS,        T,VOLUME(6),  VQL(60),WEIGHT(6),  022575      455
     C                 XLTOT,     XMEH,   XMEINV,     XMEL,   XMEVL,   022575      456
     D                  XMEW,    XMEWT,    XVEST                        022575      457
      DATA E,XNU,SIGY,PI/1.E7,.33,3.E4,3.1416/                          NASA       3131
      TB= 0.                                                            NASA       3132
      XXNU= 1. - XNU**2                                                 NASA       3133
      VARAY=0.                                                          NASA       3134
      ICHECK= 1                                                         NASA       3135
      IF((NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5).AND.         NASA       3136
     *XCGSA1.EQ.2) ICHECK= 2                                            NASA       3137
C     ICHECK= 2 MEANS THAT SOLAR ARRAYS ARE PADDLES AND MOUNTED AT      NASA       3138
C     CENTER OF VEHICLE. ICHECK= 1 MEANS OTHERWISE.                     NASA       3139
C                                                                       NASA       3140
      XL= EQBLG                                                         NASA       3141
      IF(ICHECK.EQ.2) XL= .5*EQBLG                                      NASA       3142
      IF(NCONF(5).NE.1.AND.NCONF(5).NE.3.AND.NCONF(5).NE.5) GO TO 2     NASA       3143
C                                                                       NASA       3144
C     SOLAR ARRAYS ARE PADDLES                                          NASA       3145
```

```
C                                                                       NASA  3146
C     APPLIED LOAD (ONLY BENDING MOMENT)                                NASA  3147
C                                                                       NASA  3148
C     COMPUTE WEIGHT PER PADDLE (ASSUME 2 PADDLES)                      NASA  3149
      WE= .5*SOARWT                                                     NASA  3150
C                                                                       NASA  3151
      XMA= 1.25*SABOLG*WE*SQRT(CA*CA + CE*CE)                           NASA  3152
C                                                                       NASA  3153
C     NOMINAL TUBE RADIUS                                               NASA  3154
C                                                                       NASA  3155
      R= (SABOLG**4*XMA/(PI**5*E))**.1428                               NASA  3156
C                                                                       NASA  3157
C     TUBE WALL THICKNESS                                               NASA  3158
C                                                                       NASA  3159
      TW=  2.*SQRT(XMA/(PI*E*R))                                        NASA  3160
C                                                                       NASA  3161
C     CHECK FOR APPLICABILITY OF EULER COLUMN STABILITY                 NASA  3162
C                                                                       NASA  3163
      FAC1= (PI*E**2*XMA/(8.*R*SABOLG**2))**.3333                       NASA  3164
      IF(SIGY-FAC1.GE.0.) GO TO 1                                       NASA  3165
C                                                                       NASA  3166
C     EULER COLUMN STABILITY NOT APPLICABLE                             NASA  3167
C                                                                       NASA  3168
      TW= (16.*SIGY*XMA/(PI*E**2))**.3333                               NASA  3169
      R= TW*E/(4.*SIGY)                                                 NASA  3170
C                                                                       NASA  3171
C     VOLUME OF SOLAR BOOM                                              NASA  3172
C                                                                       NASA  3173
    1 VARAY=R*TW*SABOLG                                                 NASA  3174
C                                                                       NASA  3175
C     SIZING OF EQUIPMENT BAY STRUCTURE                                 NASA  3176
C                                                                       NASA  3177
    2 CONTINUE                                                          NASA  3178
C                                                                       NASA  3179
      P= CA*SATWT                                                       NASA  3180
C                                                                       NASA  3181
C     BENDING MOMENT                                                    NASA  3182
C                                                                       NASA  3183
C                                                                       NASA  3184
      XM= .75*CE*EQBLG*SATWT                                            NASA  3185
C                                                                       NASA  3186
      IF(ICHECK.EQ.1) XM= CE*EQBLG*SATWT                                NASA  3187
      IF(NCONF(6).NE.1) GO TO 5                                         NASA  3188
C                                                                       NASA  3189
C     EQUIVALENT AXIAL LOAD                                             NASA  3190
C                                                                       NASA  3191
      RR= .5*SATDAM                                                     NASA  3192
      XN= P/(2.*PI*RR) + XM/(PI*RR*RR)                                  NASA  3193
C                                                                       NASA  3194
C     SIZING OF EQUIVALENT MONOCOQUE CYLINDER                           NASA  3195
C                                                                       NASA  3196
C                                                                       NASA  3197
      TM= .672*(XXNU*XN*XL*XL/E)**.3333                                 NASA  3198
      FAC2= XL**2*SQRT(XXNU)/(RR*TM)                                    NASA  3199
      IF(FAC2.LE.31) GO TO 3                                            NASA  3200
      TM= 2.76*SQRT(SQRT(XXNU)*XN*RR/E)                                 NASA  3201
    3 CONTINUE                                                          NASA  3202
```

```
C
C     EQUIVALENT THICKNESS OF STIFFENED CYLINDER
C
      TBAR= .267*TM
C
C     SIZING OF SKIN-STRINGER ASSEMBLY
C
      T= .44*TBAR
      TS= 1.9*T
      BS= .64*TS*SQRT(E*TBAR/(XXNU*XN))
      B= 1.49*BS
      N= 1. + 2.*PI*RR/B
      AN= N
      B= 2.*PI*RR/AN
      ALPHA= .745/XXNU**.25
C
C     SIZING OF CYLINDER FRAMES
C
      A= E*ALPHA**2*TBAR**2/XN
      RHOF= .0564*(RR**2/A)*(XN*ALPHA**2/(E*A))**.25
      AF= .000785*XN*RR**4/(E*RHOF**2*A)
      BF= 3.464*RHCF
      TF= AF/BF
      M= 1. + XL/A
      AM= M
      A= XL/AM
C
C     SIZING OF END COVERS
C
      TC= .352*SQRT(CA*SATWT/SIGY)
      TA= TC
      XLD= RR
C
C     VOLUME OF EQUIPMENT BAY STRUCTURE
C
      VEQ=EQBLG*(T+(TS*BS/B)+(TF*BF/A))
      IF(ICHECK.EQ.1) GO TO 4
C
C     MID-SECTION BULKHEAD IS REQUIRED
C
      WL= .455*CA*SATWT/XLD**2
      TB=.859*XLD*SQRT(WL/SIGY)
      VEQ=2.*VEQ+0.219*TB*RR
    4 CONTINUE
C
C     TOTAL STRUCTURE WEIGHT
C
      VEQ=VEQ+RR*TC
      STRWAT=2.*PI*0.1*(RR*VEQ+4.*VARAY)
C
      RETURN
C
    5 CONTINUE
C
      IF(NCONF(6).NE.2) RETURN
C
      W= .707*SATDAM
```

```
C
C     EQUIVALENT AXIAL LOAD
C
      XN= .25*P/W + .75*XM/W**2
C
C     SIZING OF EQUIVALENT MONOCOQUE BOX
C
      IF(XL/W.LE..5) TM= 1.068*(XXNU*XN*XL*XL/E)**.3333
      IF(XL/W.GT..5) TM= .672*(XXNU*XN*W*W/E)**.3333
C
C     EQUIVALENT THICKNESS OF STIFFENED BOX
C
      TBAR= .267*TM
C
C     SIZING OF SKIN STRINGER ASSEMBLY
C
      T= .44*TBAR
      TS= 1.9*T
      BS= .64*TS*SQRT(E*TBAR/(XXNU*XN))
      B= 1.49*BS
      N= 1. + W/B
      N= 4*N
      AN= N
      B= W/AN
      ALPHA= .745/XXNU**.25
C
C     SIZING OF FRAMES
C
      A= E*ALPHA**2*TBAR**2/XN
      RHOF= .405*(W**2/A)*(XN*ALPHA**2/(E*A))**.25
      AF= .041*XN*W**4/(E*RHOF**2*A)
      BF= 3.464*RHOF
      TF= AF/BF
      M= 1. + XL/A
      AM= M
      A= XL/AM
C
C     SIZING OF END COVERS
C
      TC= .303*SQRT(CA*SATWT/SIGY)
      TA= TC
      XLD= .5*W
C
C     VOLUME OF EQUIPMENT BAY STRUCTURE
C
      VEQ=2.*(T+(TS*BS/B)+(TF*BF/A))
      IF(ICHECK.EQ.1) GO TO 6
C
C     MID-SECTION BULKHEAD IS REQUIRED
C
      WL= .455*CA*SATWT/XLD**2
      TB=.859*XLD*SQRT(WL/SIGY)
      VEQ=2.*VEQ+0.219*W*TB
C
    6 CONTINUE
C
C     TOTAL STRUCTURAL WEIGHT
```

```
C                                                     NASA    3317
      VEQ=2.*W*EQBLG*VEQ+2.*TC*(W**2)                 NASA    3318
      STRWAT=0.1*(VEQ+8.*PI*VARAY)                    NASA    3319
C                                                     NASA    3320
  230 RETURN                                          NASA    3321
      END                                             NASA    3322
```

```
      SUBROUTINE VESIZE(IERR,NCONF,ICHOSE)                                  NASA      3323
      DIMENSION NCONF(6),EESID(9),EEYCG(9),EEZCG(9),EEINX(9),EEINY(9),      NASA      3324
     * EEINZ(9),EEXCG(9)                                                    NASA      3325
      COMMON /USER6/ CGEEX(9), EELOC(9), EEQVL(9),    EM1YCG,    EM1ZCG,    022575     458
     1         EQPF,     EM2YCG,     EM2ZCG,   ISBOFG,    NUMEEQ,    XCGSA3 022575     459
C                                                                           022575     460
      COMMON /USERI/     APOGEE,     COMRAT,     DIAMAX, EEQWT(9),     EPME, 022575     461
     1                   EQM1WT,     EQM1XL,     EQM1YL,    EQM1ZL,    EQM2WT, 022575     462
     2                   EQM2XL,     EQM2YL,     EQM2ZL,        FE,    IAGNCY, 022575     463
     3         IDEBUG,   ISATOR,     MB12SH,     OPTEMP,    ORBINC,    PERIGE, 022575     464
     4          MICRO,    RELME,    SPEC(6),      SPEC1,         T,    XCGSA1, 022575     465
     5                     XMER,       XMEU                                 022575     466
C                                                                           022575     467
      COMMON /BTWN/        ACSSN,      ACSWP,        ALT,    SOAREA,    BATCAP, 022575     468
     1               BITRAT(2),      CLIFE,     CONVWT,    SATDAM,        DT, 022575     469
     2                       DX,         DY,         DZ,     EQBLG,    EQBSID, 022575     470
     3                       FC,         FF,     HARNWT,       HPT,    HTPIPE, 022575     471
     4                     HTPT,     HTRPRB,     HTRPWR,               IBTLOC, 022575     472
     5                    LMBDD,         NC,      OMEGS,    PASSTR,        PJ, 022575     473
     6                       PL,      PLMIN,     POCNWT,      RADA,     RADAB, 022575     474
     7                      RAT,         RJ,     SABOLG,     SATLG,    SATTWT, 022575     475
     8                    SATWT,     SATXCG,     SATYCG,    SATZCG,     SA1XL, 022575     476
     9                    SA1YL,      SA1ZL,       SIDE,     SYSLB,    THCMWT, 022575     477
     A               THRUST(2),         TI,      TNKWT,     TPRIM,        VB, 022575     478
     B                     VCHP,     SATVOL,     SOARWT,        WB,       WBT, 022575     479
     C                   STINWT,     SATINX,     XNZERO,    SATINY,    SATINZ 022575     480
C                                                                           022575     481
      COMMON/PRTCOM/     ACCRCY,         AM,         AN,        BF,        BS, 022575     482
     1               CDPI(7,2),     CISTAR,       CTOT,      DDTE,        DE, 022575     483
     2                    DRIWT,     EQBSTR,     FEEINV,    FEEOPS,      FEER, 022575     484
     3                      GSE,       IREL,     ITRUNC,    MMDOLD,NAME(3,60), 022575     485
     4                      OPS,     PAYINV,     PAYQUL,      PAYR,        PE, 022575     486
     5                      PMP,        PMR,   POWER(6),        PU,   PWR(60), 022575     487
     6                      QCP,        QCR,   ROLD(60),    SABMWT,    SATADP, 022575     488
     7                   SATINV,       SATR,       SEIP,      SEIR, SKTAU(6), 022575     489
     8                 SSREL(6),    SUBE(7),    SUBT(7),  SUBUE(7),  SUBUP(7), 022575     490
     9                       TA,   TAU(6,6),         TB,        TC,        TE, 022575     491
     A                       TF,      TOOLR,      TOOLU,    TOTOPS,     TRUNC, 022575     492
     B                       TS,        TTT,  VOLUME(6),   VQL(60), WEIGHT(6), 022575     493
     C                   XLTOT,       XMEH,     XMEINV,      XMEL,     XMEVL, 022575     494
     D                     XMEW,      XMEWT,      XVEST                     022575     495
      ISHAPE = NCONF(6)                                                     NASA      3336
      ISPIN = 0                                                             NASA      3337
      RLD  =  0.600                                                         122674       1
      XMEL=EQM1XL+EQM2XL                                                    111274       1
      XMEW = AMAX1(EQM1YL,EQM2YL)                                           111274       2
      XMEH = AMAX1(EQM1ZL,EQM2ZL)                                           111274       3
      EQM1ST = 0.0                                                          111274       4
      EQM2ST = 0.0                                                          111274       5
      IF(NCONF(1).EQ.1.OR.NCONF(1).EQ.2) ISPIN = 1                          NASA      3339
      IEQTYP = 1                                                            NASA      3340
      IF(NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5) IEQTYP=2          NASA      3341
C     DETERMINE EQUIPMENT BAY EQUIPMENT WEIGHT AND VOLUME                   NASA      3342
      EQWT = 1.025 *STINWT                                                  111874      49
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      EQVOL= 1.025*SATVOL                                               NASA      3344
      THCNWT = 0.025 * STINWT                                           111874      50
C     THE THERMAL CONTROL SUBSYSTEM IS ACCOUNTED FOR BY THE 1.025 FACTOR NASA     3346
C     NOTE THAT VOLUMES ARE IN FT**3                                    NASA      3347
C                                                                       NASA      3348
C     ACCOUNT FOR PACKING FACTOR                                        NASA      3349
C                                                                       NASA      3350
      EQBVOL= 1728.*EQVOL*EQPF                                          NASA      3351
C                                                                       NASA      3352
C     DETERMINE EQUIPMENT BAY LENGTH                                    NASA      3353
C                                                                       NASA      3354
      ICHOSE=0                                                          NASA      3355
      IF(ISHAPE-2)1,2,3                                                 NASA      3356
    1 SATDAM= (EQBVOL/(.785*RLD))**.333                                 NASA      3357
      EQBLG=RLD*SATDAM                                                  NASA      3358
      IF(SATDAM.LE.DIAMAX) GO TO 4                                      NASA      3359
      SATDAM= DIAMAX                                                    NASA      3360
      EQBLG= EQBVOL/(.785*SATDAM**2)                                    NASA      3361
      GO TO 4                                                           NASA      3362
    2 EQBLG = EQBVOL**.333                                              122674       2
      SATDAM = 1.4142 * EQBLG                                           122674       3
      IF(SATDAM.LE.DIAMAX) GC TO 4                                      NASA      3365
      SATDAM= DIAMAX                                                    NASA      3366
      EQBLG= 2.*EQBVOL/SATDAM**2                                        NASA      3367
      GO TO 4                                                           NASA      3368
    3 SATDAM= (EQBVOL/.524)**.333                                       NASA      3369
      EQBLG= SATDAM                                                     NASA      3370
      IF(SATDAM.LE.DIAMAX) GO TO 4                                      NASA      3371
      ICHOSE=-1                                                         NASA      3372
C     THAT IS, THIS IS NOT AN ACCEPTABLE MACRO CONFIGURATION            NASA      3373
      RETURN                                                            NASA      3374
    4 CONTINUE                                                          NASA      3375
C     DETERMINE SOLAR ARRAY DIMENSIONS                                  NASA      3380
C                                                                       NASA      3381
      IERR=0                                                            NASA      3382
      SAAREA = 144.*SOAREA                                              NASA      3383
      GO TO (11,14,17),ISHAPE                                           122674       4
   11 GO TO (12,20),IEQTYP                                              011375      11
   12 IF (ISPIN.EQ.0) GO TO 13                                          011375      12
      SURF = 3.14159 * SATDAM * EQBLG                                   011375      13
      IF (SURF .GE. SAAREA) GO TO 20                                    122674       7
      SATDAM = SQRT(SAAREA/1.88496)                                     122674       8
      EQBLG  =  0.6 * SATDAM                                            122674       9
      EQBVOL = 0.785 * SATDAM**2 * EQBLG                                122674      10
      IF (SATDAM .LE. DIAMAX) GO TO 20                                  122674      11
      SATDAM = DIAMAX                                                   122674      12
      EQBLG  = SAAREA/(3.14159*SATDAM)                                  122674      13
      EQBVOL = 0.785 * SATDAM**2 * EQBLG                                122674      14
      GO TO 20                                                          122674      15
   13 SURF = 1.5708 * SATDAM * EQBLG                                    122674      16
      IF (SURF .GE. SAAREA) GO TO 20                                    122674      17
      SATDAM = SQRT(SAAREA/.94248)                                      122674      18
      EQBLG  = 0.6 * SATDAM                                             122674      19
      EQBVOL = 0.785 * SATDAM**2 * EQBLG                                122674      20
      IF (SATDAM .LE. DIAMAX) GO TO 20                                  122674      21
      SATDAM = DIAMAX                                                   122674      22
      EQBLG  = 2.*SAAREA/(3.14159*SATDAM)                               122674      23
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      EQBVOL = 0.785 * SATDAM**2 * EQBLG                                122674    24
      GO TO 20                                                          122674    25
C                                                                       122674    26
   14 GO TO (15,20),IEQTYP                                              011375    14
   15 IF (ISPIN.EQ.1) GO TO 20                                          011375    15
      SURF = SATDAM * EQBLG / 1.4142                                    011375    16
      IF (SURF .GE. SAAREA) GO TO 20                                    122674    31
      SATDAM = SQRT (SAAREA)* 1.4142                                    122674    32
      EQBLG  = SATDAM                                                   122674    33
      EQBVOL = 0.500 * SATDAM**2 * EQBLG                                122674    34
      IF (SATDAM .LE. DIAMAX) GO TO 20                                  122674    35
      SATDAM = DIAMAX                                                   122674    36
      EQBLG = 1.4142 * SAAREA / SATDAM                                  122674    37
      EQBVOL = 0.500 * SATDAM**2 * EQBLG                                122674    38
      GO TO 20                                                          122674    39
C                                                                       122674    40
   17 GO TO (18,20),IEQTYP                                              011375    17
   18 IF (ISPIN.EQ.0) GO TO 19                                          011375    18
      SURF = 3.14159 * SATDAM**2                                        011375    19
      IF (SURF .GE. SAAREA) GO TO 20                                    122674    43
      SATDAM = SQRT(SAAREA/3.14159)                                     122674    44
      EQBVOL = 0.524 * SATDAM**3                                        122674    45
      IF (SATDAM .LE. DIAMAX) GO TO 20                                  122674    46
      ICHOSE = -1                                                       122674    47
C     THAT IS WE CANNOT LENGTHEN A SPHERE                               122674    48
      RETURN                                                            122674    49
   19 SURF = 1.5708 * SATDAM**2                                         122674    50
      IF (SURF .GE. SAAREA) GO TO 20                                    122674    51
      SATDAM = SQRT(2.*SAAREA/3.14159)                                  122674    52
      EQBVOL = 0.524 * SATDAM**3                                        122674    53
      IF (SATDAM .LE. DIAMAX) GO TO 20                                  122674    54
      ICHOSE = -1                                                       122674    55
C     THAT IS WE CANNOT LENGTHEN A SPHERE                               122674    56
      RETURN                                                            122674    57
C                                                                       122674    58
   20 CONTINUE                                                          122674    59
C                                                                       122674    60
C     DETERMINE SATELLITE LENGTH                                        122674    61
C                                                                       122674    62
      SATLG = EQBLG + EQM1XL + EQM2XL                                   122674    63
      IF(IEQTYP.EQ.2) GO TO 54                                          NASA    3384
      IF(ISHAPE-2) 51,52,53                                             NASA    3385
   51 SA3XL= SAAREA/SATDAM                                              NASA    3386
      IF(SA3XL.LE.EQBLG) GO TO 55                                       NASA    3387
      IERR=IERR+1                                                       NASA    3388
      GO TO 55                                                          NASA    3389
   52 SA3XL= 1.414*SAAREA/SATDAM                                        NASA    3390
      IF(SA3XL.LE.EQBLG) GO TO 55                                       NASA    3391
      IERR=IERR+1                                                       NASA    3392
      GO TO 55                                                          NASA    3393
   53 SA3XL= SQRT(1.273*SAAREA)                                         NASA    3394
      IF(SA3XL.LE.SATDAM) GO TO 55                                      NASA    3395
      IERR=IERR+1                                                       NASA    3396
      GO TO 55                                                          NASA    3397
   54 SA1YL= .005208*SAAREA                                             NASA    3398
      SA1XL= 96.                                                        NASA    3399
      SA1ZL= 1.                                                         NASA    3400
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```
      SA2YL= SA1YL                                                      NASA      3401
      SA2XL= SA1XL                                                      NASA      3402
      SA2ZL= SA1ZL                                                      NASA      3403
   55 CONTINUE                                                          NASA      3404
C                                                                       NASA      3405
C     DETERMINE EQUIPMENT BAY STRUCTURAL WEIGHT                         NASA      3406
C                                                                       NASA      3407
      EQBSTR= .218*EQWT**.986*(EQBLG/SATDAM)**.263                      NASA      3408
      IF(IEQTYP.EQ.2) EQBSTR= .59*EQBSTR                                NASA      3409
      EQBSTR=EQBSTR+0.10*EQWT                                           120274       2
C     DETERMINE STRUCTURAL THERMAL PROTECTION WEIGHT                    120474      13
      STTPS = 0.025 * EQBSTR                                            120474      14
      EQBSTR = EQBSTR + STTPS                                           120474      15
      EQBWT=EQWT+EQBSTR                                                 120274       3
C                                                                       NASA      3459
C     DETERMINE MISSION EQUIPMENT BAY TOTAL VOLUME                      NASA      3460
C                                                                       NASA      3461
      IF(MB12SH.EQ.2) GO TO 150                                         NASA      3462
      EQM1VL= .785*EQM1YL**2*EQM1XL                                     NASA      3463
      EQM2VL= .785*EQM2YL**2*EQM2XL                                     NASA      3464
      GO TO 151                                                         NASA      3465
  150 CONTINUE                                                          NASA      3466
      EQM1VL= EQM1XL*EQM1YL*EQM1ZL                                      NASA      3467
      EQM2VL= EQM2XL*EQM2YL*EQM2ZL                                      NASA      3468
  151 CONTINUE                                                          NASA      3469
      EQMVOL= EQM1VL + EQM2VL                                           NASA      3470
C                                                                       NASA      3471
C     DETERMINE SA1WT,SA2WT,SA3WT                                       NASA      3472
C                                                                       NASA      3473
      SA3WT = SOARWT                                                    NASA      3474
      IF(IEQTYP.EQ.1) GO TO 152                                         NASA      3475
      SA1WT = .5*SOARWT                                                 NASA      3476
      SA2WT = SA1WT                                                     NASA      3477
  152 CONTINUE                                                          NASA      3478
C                                                                       NASA      3479
C     DETERMINE BOOM AND MECHANISM WEIGHT                               NASA      3480
C                                                                       NASA      3481
      SABOLG= 0.                                                        NASA      3482
      SABOOM= 0.                                                        NASA      3483
      SADRIV= 0.                                                        NASA      3484
      IF(ISPIN.EQ.1) GO TO 23                                           NASA      3485
      SABOLG= 24.                                                       NASA      3486
      SABOOM= 15.2                                                      NASA      3487
      IF(ISBOFG.EQ.0) GO TO 23                                          NASA      3488
      SADRIV= .166*(SA1WT + SA2WT)                                      NASA      3489
   23 CONTINUE                                                          NASA      3490
      SABMWT= SABOOM + SADRIV                                           NASA      3491
C                                                                       NASA      3492
C     CALCULATE HARNESS AND STRUCTURAL TPS WEIGHT                       NASA      3493
C                                                                       NASA      3494
C                                                                       NASA      3495
C     FIRST NEED MISSION EQUIPMENT WEIGHT AND EXTERNAL EQUIPMENT WEIGHT NASA      3496
C     AND VOLUME                                                        NASA      3497
C                                                                       NASA      3498
      EQMWT= EQM1WT+ EQM2WT                                             NASA      3499
      EEQTWT= 0.                                                        NASA      3500
      EEQVOL= 0.                                                        NASA      3501
```

```
      IF(NUMEEQ.EQ.0) GO TO 232                                         NASA    3502
      DO 231 I=1,NUMEEQ                                                 NASA    3503
      EEQTWT= EEQTWT + EEQWT(I)                                         NASA    3504
      EEQVOL= EEQVOL + EEQVL(I)                                         NASA    3505
  231 CONTINUE                                                          NASA    3506
  232 CONTINUE                                                          NASA    3507
      XMEWT = EQMWT + EEQTWT                                            111874    52
      XMEVL =(EQMVOL + EEQVOL)/1728.                                    111874    53
C                                                                       NASA    3508
      HARNWT = 0.013 * (STINWT-WBT-ACSWP+.5*EEQTWT+.5*EQMWT)**1.31      111874    54
     *         * (EQBVOL/1728.)**0.16                                   111874    55
C                                                                       NASA    3515
C     DETERMINE SATELLITE DRY WEIGHT LESS AUXILIARY PROPULSION DRY      NASA    3516
C     WEIGHT                                                            NASA    3517
C                                                                       NASA    3518
C     FIRST DETERMINE SOLAR ARRAY WEIGHT                                NASA    3519
C                                                                       NASA    3520
      SOARWT= 0.                                                        NASA    3521
      IF(IEQTYP.EQ.2) GO TO 233                                         NASA    3522
      SOARWT= SA3WT                                                     NASA    3523
      GO TO 234                                                         NASA    3524
  233 SOARWT= SA1WT + SA2WT                                             NASA    3525
  234 CONTINUE                                                          NASA    3526
C                                                                       NASA    3527
      PASSTR=EQBSTR+EQM1ST+EQM2ST+SABOOM+SADRIV                         120474    16
      SUBWT1= EQMWT + EQM1ST + EQM2ST + SOARWT + EEQTWT + SABMWT        NASA    3529
      SUBWT2=SUBWT1+EQWT+HARNWT+EQBSTR-ACSWP                            120474    17
      SUBWT = SUBWT2                                                    111274     6
      DRYWT= SUBWT                                                      NASA    3533
      SYSLB = EQMWT + EQM1ST + EQM2ST + EEQTWT                          011475    33
     1        + EQBSTR+ SOARWT + SABMWT + HARNWT                        011475    34
C                                                                       NASA    3534
C     DETERMINE SATELLITE GROSS WEIGHT                                  NASA    3535
C                                                                       NASA    3536
      SATWT= DRYWT + ACSWP                                              NASA    3537
C                                                                       NASA    3538
C     DETERMINE ADAPTER WEIGHT                                          NASA    3539
C                                                                       NASA    3540
      SATADP= .012*SATWT                                                NASA    3541
C                                                                       NASA    3542
C     DETERMINE SATELLITE LAUNCH WEIGHT                                 NASA    3543
C                                                                       NASA    3544
      SATTWT= SATWT + SATADP                                            NASA    3545
C                                                                       NASA    3546
C     CENTER OF GRAVITY CALCULATIONS                                    NASA    3547
C                                                                       NASA    3548
      EBXCG= 500. + .5*EQBLG                                            NASA    3549
      EBYCG= 0.                                                         NASA    3550
      EBZCG= 0.                                                         NASA    3551
C                                                                       NASA    3552
C     MISSION EQUIPMENT AND MISSION EQUIPMENT BAY STRUCTURE C.G.        NASA    3553
C                                                                       NASA    3554
      EM1XCG= 500. + EQBLG + .5*EQM1XL                                  NASA    3555
      EM2XCG= 500. - .5*EQM2XL                                          NASA    3556
C                                                                       NASA    3557
C     EQUIPMENT BAY STRUCTURE C.G.                                      NASA    3558
C                                                                       NASA    3559
```

```
      STRXCG= 500. + .5*EQBLG
      STRYCG= 0.
      STRZCG= 0.
C
C     EXTERNAL EQUIPMENT C.G.
      IF(NUMEEQ.EQ.0) GO TO 240
      CO 239 I=1,NUMEEQ
      EESIO(I)= (1728.*EEQVL(1))**.333
      IF(CGEEX(I)-2.) 235,236,237
  235 EEXCG(I)= 500. + EQBLG
      GO TO 238
  236 EEXCG(I)= 500. + .5*EQBLG
      GO TO 238
  237 EEXCG(I)= 500.
  238 CONTINUE
      EEYCG(I)= 0.
      EEZCG(I)= 0.
      IF(EELOC(I).EQ.1.) EEYCG(I)= .5*(SATDAM + EESIO(I))
      IF(EELOC(I).EQ.2.) EEYCG(I)= -.5*(SATDAM + EESID(I))
      IF(EELOC(I).EQ.3.) EEZCG(I)= -.5*(SATDAM + EESID(I))
      IF(EELOC(I).EQ.4.) EEZCG(I)= .5*(SATDAM + EESIO(I))
  239 CONTINUE
  240 CONTINUE
C
C     SOLAR ARRAY C.G.S
C
      IF(IEQTYP.EQ.2) GO TO 244
      SA3YCG= 0.
      SA3ZCG= 0.
      IF(XCGSA3-2.) 241,242,243
  241 SA3XCG= 500. + EQBLG
      GO TO 249
  242 SA3XCG= 500. + .5*EQBLG
      GO TO 249
  243 SA3XCG= 500.
      GO TO 249
  244 CONTINUE
      IF(XCGSA1-2.) 245,246,247
  245 SA1XCG= 500. + EQBLG
      GO TO 248
  246 SA1XCG= 500. + .5*EQBLG
      GO TO 248
  247 SA1XCG= 500.
  248 CONTINUE
      SA2XCG= SA1XCG
      SA1YCG= 24. + .5*(SATDAM + SA1YL)
      SA2YCG= -SA1YCG
      SA1ZCG= 0.
      SA2ZCG= 0.
      SABXCG= SA1XCG
      SABYCG= 0.
      SABZCG= 0.
  249 CONTINUE
C
C     SATELLITE CENTER OF GRAVITY CALCULATIONS
C
C     FIRST DETERMINE CONTRIBUTICN OF SOLAR ARRAYS
```

```
      C                                                                  NASA    3617
            IF(IEQTYP.EQ.2) GO TO 250                                    NASA    3618
            SAX= SA3WT*SA3XCG                                            NASA    3619
            SAY= SA3WT*SA3YCG                                            NASA    3620
            SAZ= SA3WT*SA3ZCG                                            NASA    3621
            GO TO 251                                                    NASA    3622
        250 CONTINUE                                                     NASA    3623
            SAX= SA1WT*SA1XCG + SA2WT*SA2XCG + SABMWT*SABXCG             NASA    3624
            SAY= SA1WT*SA1YCG + SA2WT*SA2YCG + SABMWT*SABYCG             NASA    3625
            SAZ= SA1WT*SA1ZCG + SA2WT*SA2ZCG + SABMWT*SABZCG             NASA    3626
        251 CONTINUE                                                     NASA    3627
      C                                                                  NASA    3628
      C     NEXT DETERMINE CONTRIBUTION OF EXTERNAL EQUIPMENT            NASA    3629
      C                                                                  NASA    3630
            EEX=0.                                                       NASA    3631
            EEY=0.                                                       NASA    3632
            EEZ=0.                                                       NASA    3633
            IF(NUMEEQ.EQ.0) GO TO 253                                    NASA    3634
            DO 252 I=1,NUMEEQ                                            NASA    3635
            EEX= EEX + EEQWT(I)*EEXCG(I)                                 NASA    3636
            EEY= EEY + EEQWT(I)*EEYCG(I)                                 NASA    3637
            EEZ= EEZ + EEQWT(I)*EEZCG(I)                                 NASA    3638
        252 CONTINUE                                                     NASA    3639
        253 CONTINUE                                                     NASA    3640
      C                                                                  NASA    3641
            SATXCG= (EQBSTR*STRXCG + EQWT*EBXCG + (EQM1ST + EQM1WT)*EM1XCG + NASA    3642
           1 (EQM2ST + EQM2WT)*EM2XCG + SAX +                    EEX +   NASA    3643
           2  (HARNWT+STTPS)*EBXCG)/SATWT                                111274     7
      C                                                                  NASA    3645
            SATYCG= (EQBSTR*STRYCG + EQWT*EBYCG + (EQM1ST + EQM1WT)*EM1YCG + NASA    3646
           1 (EQM2ST + EQM2WT)*EM2YCG + SAY +                    EEY +   NASA    3647
           2  (HARNWT+STTPS)*EBYCG)/SATWT                                111274     8
      C                                                                  NASA    3649
            SATZCG= (EQBSTR*STRZCG + EQWT*EBZCG + (EQM1ST + EQM1WT)*EM1ZCG + NASA    3650
           1 (EQM2ST + EQM2WT)*EM2ZCG + SAZ +                    EEZ +   NASA    3651
           2  (HARNWT+STTPS)*EBZCG)/SATWT                                111274     9
      C                                                                  NASA    3653
      C     CALCULATE MOMENTS OF INERTIA                                 NASA    3654
      C                                                                  NASA    3655
      C     FIRST DETERMINE EQUIPMENT BAY STRUCTURE AND EQUIPMENT BAY    NASA    3656
      C     EQUIPMENT INCREMENTAL INERTIA                                NASA    3657
      C                                                                  NASA    3658
            SATRAD= .5*SATDAM                                            NASA    3659
            IF(ISHAPE - 2) 66,67,68                                      NASA    3660
         66 STRINX= EQBSTR*SATRAD**2                                     NASA    3661
            STRINY= .5*EQBSTR*(SATRAD**2 + .167*EQBLG**2)                NASA    3662
            STRINZ= STRINY                                               NASA    3663
            EQINX= .5*EQWT*SATRAD**2                                     NASA    3664
            EQINY= .0833*EQWT*(3.*SATRAD**2 + EQBLG**2)                  NASA    3665
            EQINZ= EQINY                                                 NASA    3666
            SIDE = SATDAM                                                111274    10
            GO TO 69                                                     NASA    3667
         67 EQBSID= .708*SATDAM                                          NASA    3668
            STRINX= .333*EQBSTR*EQBSID**2                                NASA    3669
            STRINY= .0833*EQBSTR*(2.*EQBSID**2 + EQBLG**2)               NASA    3670
            STRINZ= STRINY                                               NASA    3671
            EQINX= .167*EQWT*EQBSID**2                                   NASA    3672
```

```
      EQINY= .0833*EQWT*(EQBSID**2 + EQBLG**2)                          NASA      3673
      EQINZ= EQINY                                                      NASA      3674
      SIDE = EQBSID                                                     111274      11
      GO TO 69                                                          NASA      3675
   68 STRINX= .167*EQBSTR*SATDAM**2                                     NASA      3676
      STRINY= STRINX                                                    NASA      3677
      STRINZ= STRINX                                                    NASA      3678
      EQINX= .1*EQWT*SATDAM**2                                          NASA      3679
      EQINY= EQINX                                                      NASA      3680
      EQINZ= EQINX                                                      NASA      3681
      SIDE = SATDAM                                                     111274      12
   69 CONTINUE                                                          NASA      3682
      IF (NUMEEQ .EQ. 0) GO TO 71                                       NASA      3683
C                                                                       NASA      3684
C     EXTERNAL EQUIPMENT INCREMENTAL INERTIA (BOX SHAPE)                NASA      3685
C                                                                       NASA      3686
      DO 70 I=1,NUMEEQ                                                  NASA      3687
      EEINX(I)=  .167*EEQWT(I)*EESID(I)**2                              NASA      3688
      EEINY(I)= EEINX(I)                                                NASA      3689
      EEINZ(I)= EEINX(I)                                                NASA      3690
   70 CONTINUE                                                          NASA      3691
   71 CONTINUE                                                          NASA      3692
C                                                                       NASA      3693
C     SOLAR ARRAY INERTIAL CALCULATIONS                                 NASA      3694
C                                                                       NASA      3695
      IF(IEQTYP.EQ.2) GO TO 37                                          NASA      3696
      SA3INX= SA3WT*SATRAD**2                                           NASA      3697
      SA3INY= .5*SA3WT*(SATRAD**2 + .167*SA3XL**2)                      NASA      3698
      SA3INZ= SA3INY                                                    NASA      3699
      GO TO 38                                                          NASA      3700
   37 SA1INX= .0833*SA1WT*(SA1YL**2 + SA1ZL**2)                         NASA      3701
      SA1INY= .0833*SA1WT*(SA1XL**2 + SA1ZL**2)                         NASA      3702
      SA1INZ= .0833*SA1WT*(SA1XL**2 + SA1YL**2)                         NASA      3703
      SA2INX= .0833*SA2WT*(SA2YL**2 + SA2ZL**2)                         NASA      3704
      SA2INY= .0833*SA2WT*(SA2XL**2 + SA2ZL**2)                         NASA      3705
      SA2INZ= .0833*SA2WT*(SA2XL**2 + SA2YL**2)                         NASA      3706
   38 CONTINUE                                                          NASA      3707
C                                                                       NASA      3708
C     MISSION EQUIPMENT BAY INCREMENTAL INERTIA                         NASA      3709
C                                                                       NASA      3710
      IF(MB12SH.EQ.2) GO TO 39                                          NASA      3711
      EM1INX= .5*(EQM1ST + EQM1WT) * SATRAD**2                          NASA      3712
      EM1INY= .0833*(EQM1ST + EQM1WT)*(3*SATRAD**2 + EQM1XL**2)         NASA      3713
      EM1INZ= EM1INY                                                    NASA      3714
      EM2INX= .5*(EQM2ST + EQM2WT)*SATRAD**2                            NASA      3715
      EM2INY= .0833*(EQM2ST + EQM2WT)*(3*SATRAD**2 + EQM2XL**2)         NASA      3716
      EM2INZ= EM2INY                                                    NASA      3717
      GO TO 40                                                          NASA      3718
   39 TEM1= .0833*(EQM1ST + EQM1WT)                                     NASA      3719
      TEM2= .0833*(EQM2ST + EQM2WT)                                     NASA      3720
      EM1INX= TEM1*(EQM1YL**2 + EQM1ZL**2)                              NASA      3721
      EM1INY= TEM1*(EQM1ZL**2 + EQM1XL**2)                              NASA      3722
      EM1INZ= TEM1*(EQM1YL**2 + EQM1XL**2)                              NASA      3723
      EM2INX= TEM2*(EQM2YL**2 + EQM2ZL**2)                              NASA      3724
      EM2INY= TEM2*(EQM2ZL**2 + EQM2XL**2)                              NASA      3725
      EM2INZ= TEM2*(EQM2YL**2 + EQM2XL**2)                              NASA      3726
   40 CONTINUE                                                          NASA      3727
```

```
C
      EQM1TO= EQM1WT + EQM1ST
      EQM2TO= EQM2WT + EQM2ST
C
C     SATELLITE TOTAL INERTIA CALCULATIONS
C
C     FIRST DETERMINE CONTRIBUTION OF SOLAR ARRAYS
C
      IF(IEQTYP.EQ.2) GO TO 41
      SAIX= SA3INX + SA3WT*((SATYCG-SA3YCG)**2 + (SATZCG-SA3ZCG)**2)
      SAIY= SA3INY + SA3WT*((SATZCG-SA3ZCG)**2 + (SATXCG-SA3XCG)**2)
      SAIZ= SA3INZ + SA3WT*((SATYCG-SA3YCG)**2 + (SATXCG-SA3XCG)**2)
      GO TO 42
   41 CONTINUE
      SAIX= SA1INX + SA1WT*((SATYCG-SA1YCG)**2 + (SATZCG-SA1ZCG)**2) +
     1 SA2INX + SA2WT*((SATYCG-SA2YCG)**2 + (SATZCG-SA2ZCG)**2)
     2 + SABMWT*((SATYCG-SABYCG)**2 + (SATZCG-SABZCG)**2)
      SAIY= SA1INY + SA1WT*((SATZCG-SA1ZCG)**2 + (SATXCG-SA1XCG)**2) +
     1 SA2INY + SA2WT*((SATZCG-SA2ZCG)**2 + (SATXCG-SA2XCG)**2)
     2 + SABMWT*((SATZCG-SABZCG)**2 + (SATXCG-SABXCG)**2)
      SAIZ= SA1INZ + SA1WT*((SATYCG-SA1YCG)**2 + (SATXCG-SA1XCG)**2) +
     1 SA2INZ + SA2WT*((SATYCG-SA2YCG)**2 + (SATXCG-SA2XCG)**2)
     2 + SABMWT*((SATYCG-SABYCG)**2 + (SATXCG-SABXCG)**2)
   42 CONTINUE
C
C     NEXT DETERMINE CONTRIBUTION OF EXTERNAL EQUIPMENT
C
      EEIX= 0.
      EEIY= 0.
      EEIZ= 0.
      IF(NUMEEQ.EQ.0) GO TO 44
      DO 43 I=1,NUMEEQ
      EEIX= EEIX + EEINX(I) + EEQWT(I)*((SATYCG-EEYCG(I))**2 +
     *   (SATZCG-EEZCG(I))**2)
      EEIY= EEIY + EEINY(I) + EEQWT(I)*((SATZCG-EEZCG(I))**2 +
     *   (SATXCG-EEXCG(I))**2)
      EEIZ= EEIZ + EEINZ(I) + EEQWT(I)*((SATYCG-EEYCG(I))**2 +
     *   (SATXCG-EEXCG(I))**2)
   43 CONTINUE
   44 CONTINUE
C
      SATINX= STRINX + EQBSTR*((SATYCG-STRYCG)**2 + (SATZCG-STRZCG)**2)
     1 + EM1INX + EQM1TO*((SATYCG-EM1YCG)**2 + (SATZCG-EM1ZCG)**2)
     2 + EM2INX + EQM2TO*((SATYCG-EM2YCG)**2 + (SATZCG-EM2ZCG)**2)
     3 + EQINX + EQWT*(SATYCG**2 + SATZCG**2) + SAIX + EEIX
C
      SATINY= STRINY + EQBSTR*((SATZCG-STRZCG)**2 + (SATXCG-STRXCG)**2)
     1 + EM1INY + EQM1TO*((SATZCG-EM1ZCG)**2 + (SATXCG-EM1XCG)**2)
     2 + EM2INY + EQM2TO*((SATZCG-EM2ZCG)**2 + (SATXCG-EM2XCG)**2)
     3 + EQINY + EQWT*(SATZCG**2 + (SATXCG-STRXCG)**2) + SAIY + EEIY
C
      SATINZ= STRINZ + EQBSTR*((SATYCG-STRYCG)**2 + (SATXCG-STRXCG)**2)
     1 + EM1INZ + EQM1TO*((SATYCG-EM1YCG)**2 + (SATXCG-EM1XCG)**2)
     2 + EM2INZ + EQM2TO*((SATYCG-EM2YCG)**2 + (SATXCG-EM2XCG)**2)
     3 + EQINZ + EQWT*(SATYCG**2 + (SATXCG-STRXCG)**2) + SAIZ + EEIZ
C
C     COMPUTE DISTANCE FROM C.G. TO MAIN ENGINE(DT), GAS JET LEVER ARMS
```

```
C       ON ROLL, PITCH, AND YAW AXES, RESPECTIVELY, (DX,DY,DZ).  THE        NASA      3785
C       CONVERSION TO UNITS OF FT IS DONE IN SUBROUTINE SANDC               NASA      3786
C                                                                           NASA      3787
        IF(ISHAPE-2) 45,48,46                                               NASA      3788
     45 DT= SATXCG - 500.                                                   NASA      3789
        DX= .5*EQBLG                                                        NASA      3790
        DY= DX                                                              NASA      3791
        DZ= .5*SATDAM                                                       NASA      3792
        GO TO 47                                                            NASA      3793
     46 DT= SATXCG - 500.                                                   NASA      3794
        DX= .5*SATDAM                                                       NASA      3795
        DY= DX                                                              NASA      3796
        DZ=DX                                                               NASA      3797
        GO TO 47                                                            NASA      3798
     48 DT=.5*EQBLG                                                         NASA      3799
        DX=.5*EQBSID                                                        NASA      3800
        DY=DT                                                               NASA      3801
        CZ=DT                                                               NASA      3802
     47 PJ=EM1INX                                                           010875       8
        RJ=SATINX-PJ                                                        010875       9
        WRITE (6,1000) EQBLG,ACSWP,THCMWT,EQBSTR,SOARWT,SABMWT,             NASA      3804
       *HARNWT,SATWT                                                        NASA      3805
   1000 FORMAT(1X,8E15.4)                                                   NASA      3806
        RETURN                                                              NASA      3807
          END                                                               NASA      3808
REGISTER ALLOCATION
2 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 227
2 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 358
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 413
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      SUBROUTINE EP (IPIC,IERR,ITER,NCCNF,ICHOSE,NCHOSE)                  NASA    3809
C *****************************************************************      NASA    3810
C *   SUBROUTINE EP - -                                              *   NASA    3811
C *      WILL SELECT AND SIZE THE ELECTRICAL SUBSYSTEM WHICH WILL BE  *   NASA    3812
C *      THESE CONFIGURATIONS AS FOLLOWS - -                          *   NASA    3814
C *                NCONF (1) = 1   IS   DUAL SPIN                     *   NASA    3815
C *                NCONF (1) = 2   IS   YAW SPIN                      *   NASA    3816
C *                NCONF (1) = 3   IS   MASS EXPULSION                *   NASA    3817
C *                NCONF (1) = 4   IS   MASS EXPULSION(MOMENTUM BIAS) *   NASA    3818
C *                NCONF (1) = 5   IS   PITCH MOMENTUM BIAS           *   NASA    3819
C *                NCONF (5) = 1   IS   SHUNT  -  PADDLE              *   NASA    3820
C *                NCONF (5) = 2   IS   SHUNT  -  BODY                *   NASA    3821
C *                NCONF (5) = 3   IS   S + D -   PADDLE              *   NASA    3822
C *                NCONF (5) = 4   IS   S + D -   BODY                *   NASA    3823
C *                NCONF (5) = 5   IS   SERIES    PADDLE              *   NASA    3824
C *                NCONF (5) = 6   IS   SERIES    BODY                *   NASA    3825
C *                NCONF (6) = 1   IS   CYLINDER                      *   NASA    3826
C *                NCONF (6) = 2   IS   BOX                           *   NASA    3827
C *                NCONF (6) = 3   IS   SPHERE                        *   NASA    3828
C *****************************************************************      NASA    3829
C *      A LIST OF THE VARIABLES FOLLOWS - -                          *   NASA    3830
C *                                                                   *   NASA    3831
C *      VARIABLE  HOW USED  FROM     TO        DEFAULT   DESCRIPTION*   NASA    3832
C *                                                                   *   NASA    3833
C *      A         INT       EP       EP               FT HE + HP    *   NASA    3834
C *      A1        INT       EPS      EPS           FT**2 ARRAY AREA*   NASA    3835
C *      A32       INT       EP       EP                  A**(3/2)    *   NASA    3836
C *      ALT       I,INT     USER     EPR                MI ALTITUDE  *   NASA    3837
C *      AREA      O         EPS      VESIZE        FT**2 ARRAY AREA*   NASA    3838
C *      CA        INT       EPS      EPS              A-H MIN REQ CP*   NASA    3839
C *      CAPMAX    INT       DB       EPR              A-H MIN REQ CP*   NASA    3840
C *      CCELL     INT       DB       EPS              A-H CAP SEL CL*   NASA    3841
C *      CHMINT    INT       EPS      EPS       2.0    HRS MIN CHG TM*   NASA    3842
C *      CI        INT       EPS      EPS              A-HMIN INST CP*   NASA    3843
C *      CISTAR    INT       EPS      EPS              A-HCAP SEL CEL*   NASA    3844
C *      CR        INT       EPS      EPS              W-HMIN REQ CAP*   NASA    3845
C *      DATAB     I,INT,O   MAIN     EPR,EPS             DATA BASE   *   NASA    3846
C *      DELF      INT       EPS      EPS       .03       XMIS LOSS   *   NASA    3847
C *      DELI      INT       EPS      EPS       .02       FAB LOSS    *   NASA    3848
C *      DELM      INT       EPS      EPS       .01       MISC LOSS   *   NASA    3849
C *      DELR      INT       EPS      EPS       .05 OR .3 RAD DEG FAC*   NASA    3850
C *      DELT      INT       EPS      EPS       TABLE     TEMP.CORR.  *   NASA    3851
C *      ETAC      INT       DB       EPR       1.0       EFF CHGR    *   NASA    3852
C *      ETAD      INT       DB       EPR,EPS   0.85      EFF DISCH   *   NASA    3853
C *      ETAE      INT       DB       EPR,EPS   0.65      EFF BATT    *   NASA    3854
C *      ETAI      INT       EPS      EPS       0.105     SOLAR CL EF*   NASA    3855
C *      ETALR     INT       DB       EPR       0.90      EFF LD REG  *   NASA    3856
C *      ETAR      INT       EPR      EPR,EPS   1.0       PWR DIST LS*   NASA    3857
C *      FS        INT       EPS      EPS       -         SIZE FACT.  *   NASA    3858
C *      FW        INT       EPS      EPS       -         WT FACTOR   *   NASA    3859
C *      HE        INT       EP       EP        20.902E6FT RAD EARTH  *   NASA    3860
C *      HEDA      INT       EP       EP                  HE/A        *   NASA    3861
C *      HP        INT       EP       EP               FT PERIGEE     *   NASA    3862
C *      I         INT       EP       EP                  INT INDEX   *   NASA    3863
```

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C *     ICCU       INT        EPR        EPR                     CCU INDEX    * NASA    3864
C *     ICELL      INT        EPS        EPS                     COL INDX CL* NASA    3865
C *     ICELLE     INT        EPS        EPS                     END CELLS    * NASA    3866
C *     ICH        INT        EPR        EPR                 AMP CHG CURR     * NASA    3867
C *     ICHGR      INT        EPR        EPR                     COL INDX CH* NASA    3868
C *     ICHGRE     INT        EPS        EPS                     END CHGRS    * NASA    3869
C *     ICHOSE     O          EPR,EPS    MAIN                    HDWR ID      * NASA    3870
C *     ICCNF      INT        EPR,EPS    EPR,EPS                 VAR ON CONF* NASA    3871
C *     IDB        I          MAIN       EPR,EPS                 LAST HDWR    * NASA    3872
C *     IDR        INT        EPR        EPR                     COL INDX DR* NASA    3873
C *     IDRE       INT        EPR        EPR                     END DISCH    * NASA    3874
C *     IERR       O          EPR        MAIN                    ERROR FLG    * NASA    3875
C *     ILR        INT        EPR        EPR                     COL INDX LR* NASA    3876
C *     ILRE       INT        EPR        EPR                     END LR       * NASA    3877
C *     IPCU       INT        EPR        EPR                     PCU INDEX    * NASA    3878
C *     IPCUE      INT        EPR        EPR                     END PCU      * NASA    3879
C *     IPD        INT        EPR        EPR                     PD INDEX     * NASA    3880
C *     IPDE       INT        EPR        EPR                     END PD       * NASA    3881
C *     IPIC       I,O        EPR,EPS    MAIN                    HDWR INDEX * NASA    3882
C *     ISPD       INT        EPR        EPR                     SPD INDEX    * NASA    3883
C *     ISPDE      INT        EPR        EPR                     END SPD      * NASA    3884
C *     ISR1       INT        EPR        EPR                     SR1 INDEX    * NASA    3885
C *     ISR1E      INT        EPR        EPR                     END SR1      * NASA    3886
C *     ISR2       INT        EPR        EPR                     SR2 INDEX    * NASA    3887
C *     ISR2E      INT        EPR        EPR                     END SR2      * NASA    3888
C *     K1         INT        EPS        EPS        1.02         BATT PKG F   * NASA    3889
C *     K2         INT        EPS        EPS        1.4          BAT ST WT F* NASA    3890
C *     LMBDD      INT,O      EPR        EPR,REL    0.3          AV DP DISCH* NASA    3891
C *     LMBDG      INT        EPS        EPS        -            DRINT FACT   * NASA    3892
C *     LMBDP      INT        EPS        EPS        0.9          SLR PKG FAC* NASA    3893
C *     MU         INT        EP         EP         1.408E16     CONSTANT     * NASA    3894
C *     N          INT        EP         EP                      EARTH RATE   * NASA    3895
C *     NB         INT        EPS        EPS        2            NO BATT      * NASA    3896
C *     NC         INT        EPS        EPS                     NO SLR CELL* NASA    3897
C *     NCCU       INT        EPR        EPR                     NO.CCU       * NASA    3898
C *     NCH        INT        EPS        EPS        2            NO CHGRS     * NASA    3899
C *     NCHOSE     O          EPR,EPS    MAIN                    NO. EQUIP.   * NASA    3900
C *     NCONF(1)   I,EPS,O    MAIN       EPS,MAIN                SANDC MACRO* NASA    3901
C *     NCONF(5)   I,EP ,O    MAIN       EP ,MAIN                EP  MACRO    * NASA    3902
C *     NCONF(6)   I,EPS,O    MAIN       EPS,MAIN                VSIZE MACRO* NASA    3903
C *     ND         INT        EPR        EPR                     NO DISCH RG* NASA    3904
C *     NLR        INT        EPR        EPR                     NO LD REG    * NASA    3905
C *     NPCU       INT        EPR        EPR                     NO.PCU       * NASA    3906
C *     NPD        INT        EPR        EPR                     NO. PD       * NASA    3907
C *     NSPD       INT        EPR        EPR                     NO. SPD      * NASA    3908
C *     NSR        INT        EPR        EPR                     NO SHNT REG* NASA    3909
C *     OPTEMP     I          USER       EP         15. DEG. C BAT TEMP     * NASA    3910
C *     PBOL       INT        EPR        EPR,EPS           WATTPWR B.O.L.   * NASA    3911
C *     PD         INT        EPR        EPR               WATTBAT PWR-REG* NASA    3912
C *     PEXCES     INT        EPR        EPR,EPS           WATTPWD 2B DISP* NASA    3913
C *     PIE        INT        EPS        EPS        3.14159  CONSTANT     * NASA    3914
C *     PL         I          ALL  S/S   EPR              WATT AV PWR LD    * NASA    3915
C *     PLMIN      I          ALL  S/S   EPR              WATT MIN PWR LD * NASA    3916
C *     PLR        INT        EPR        EPR               WATTTOT PWR LRE* NASA    3917
C *     PLRD       O          EPR        THERMAL           WATTPWR DISP LR* NASA    3918
C *     PS         INT        EPR        EPR,EPS           WATTECL SOL OUT* NASA    3919
C *     RFD        INT        EPS        EPS                     TEMP DEG FC* NASA    3920
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C *        S            INT        EP         EP       . USED  IN CALC OF TE    * NASA        3921
C *        SOL          INT        EPS        EPS        1353  W/M2AV SOL INT   * NASA        3922
C *        TE           INT        EPS        EPR                 ECPS TIME     * NASA        3924
C *        TEDTS        INT        EPS        EPS                 DARK/LITE     * NASA        3925
C *        VB           INT        EPS        EPS             FT**3UNIT BATVOL* NASA        3926
C *        VBM          INT        EPR        EPS               VDCMIN BAT VLT* NASA        3927
C *        VBT          INT        EPS        EPS             FT**3TOT BAT VOL* NASA        3928
C *        VC           INT        EPS        EPS        1.1    VDCMIN CELL U * NASA        3929
C *        VCELL        INT        DB         MAIN               M3VOL CELL     * NASA        3930
C *        VDB          INT        EPR        EPR               VDCAVE ALL VOL* NASA        3931
C *        VOL          O          MAIN                       FT**3 EP VOL    * NASA        3932
C *        WATE         INT,O      EPS        VESIZE            KG ARRAY WT    * NASA        3933
C *        WB           INT        EPS        EPS                KGUNIT BAT WT* NASA        3934
C *        WBT          INT        EPS        EPS                KGTOT BAT WT  * NASA        3935
C *        WCELL        INT        DB         EPS                LB CELL WGT   * NASA        3936
C *        WT           O          MAIN                          LBS EP WT     * NASA        3937
C *                                                                            * NASA        3938
C ***************************************************************************** NASA        3939
      COMMON /USERI/    APOGEE,    COMRAT,    DIAMAX, EEQWT(9),      EPME,  022575       496
     1                  EQM1WT,    EQM1XL,    EQM1YL,   EQM1ZL,    EQM2WT,  022575       497
     2                  EQM2XL,    EQM2YL,    EQM2ZL,       FE,    IAGNCY,  022575       498
     3         IDEBUG,  ISATOR,    MB12SH,    OPTEMP,   ORBINC,    PERIGE,  022575       499
     4          MICRO,   RELME,   SPEC(6),     SPEC1,        T,    XCGSA1,  022575       500
     5                    XMER,      XMEU                                   022575       501
C                                                                           022575       502
      COMMON /BTWN/      ACSSN,     ACSWP,       ALT,     AREA,    BATCAP,  022575       503
     1              BITRAT(2),     CLIFE,    CONVWT,        D,        DT,  022575       504
     2                      DX,        DY,        DZ,    EQBLG,    EQBSID,  022575       505
     3                      FC,        FF,    HARNWT,      HPT,    HTPIPE,  022575       506
     4                    HTPT,    HTRPRB,    HTRPWR,              IBTLOC,  022575       507
     5                   LMBDD,        NC,     OMEGS,   PASSTR,        PJ,  022575       508
     6                      PL,     PLMIN,    POCNWT,     RADA,    RADAE,  022575       509
     7                     RAT,        RJ,    SABOLG,    SATLG,    SATTWT,  022575       510
     8                   SATWT,    SATXCG,    SATYCG,   SATZCG,     SA1XL,  022575       511
     9                   SA1YL,     SA1ZL,      SIDE,    SYSLB,    THCMWT,  022575       512
     A               THRUST(2),        TI,     TNKWT,    TPRIM,        VB,  022575       513
     B                    VCHP,       VOL,      WATE,       WB,       WBT,  022575       514
     C                      WT,        XJ,         N,       YJ,        ZJ   022575       515
C                                                                           022575       516
      COMMON /DBCOM/CATAB(55,100),IDE(30)                                   022575       517
C                                                                           022575       518
      COMMON/PRTCOM/    ACCRCY,        AM,        AN,       BF,        BS,  022575       519
     1               CDPI(7,2),    CISTAR,      CTOT,     DOTE,        DE,  022575       520
     2                  DRIWT,    EQBSTR,    FEEINV,   FEEOPS,      FEER,  022575       521
     3                     GSE,      IREL,    ITRUNC,   MMDOLD,NAME(3,60),  022575       522
     4                     OPS,    PAYINV,    PAYQUL,     PAYR,        PE,  022575       523
     5                     PMP,       PMR,  POWER(6),       PU,   PWR(60),  022575       524
     6                     QCP,       QCR,  ROLD(60),   SABMWT,    SATADP,  022575       525
     7                  SATINV,      SATR,      SEIP,     SEIR,  SKTAU(6),  022575       526
     8                SSREL(6),   SUBE(7),   SUBT(7), SUBUE(7),  SUBUP(7),  022575       527
     9                      TA,  TAU(6,6),        TB,       TC,        TE,  022575       528
     A                      TF,     TOOLR,     TOOLU,   TOTOPS,    TRUNC,  022575       529
     B                      TS,   TTT,VOLUME(6),   VOL(60),WEIGHT(6),  022575       530
     C                   XLTOT,      XMEH,    XMEINV,     XMEL,     XMEVL,  022575       531
     D                    XMEW,     XMEWT,     XVEST                       022575       532
      DIMENSION NCONF(10), IPIC(5), ICHOSE(5), NCHOSE(5)                    NASA        3953
      REAL MU,N,ICH,LMBDD,LMBDG,LMBDP,K1,K2                                 NASA        3954
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      DATA DELF/.03/,DELI/.02/,DELM/.01/,ETAI/.105/,ETAR/1.0/,K1/1.02/,K NASA      3955
     12/1.4/,LMBOP/.9/,SOL/1353./,VC/1.1/,PIE/3.1415926/                   NASA      3956
     *,CHMINT/2.0/                                                         NASA      3957
      WTIN = WT                                                            NASA      3958
      PL=PL+EPME                                                           NASA      3959
C **                                                                       NASA      3961
C     **  INITIALIZATION  **                                               NASA      3962
      IF (ITER.NE.0) GO TO 140                                             NASA      3963
      LMBDD=0.50                                                           122774       1
C      MEAN RADIUS OF EARTH IN FEET                                        NASA      3964
      HE = 20.92E6                                                         010975      15
      MU=1.407645E16                                                       NASA      3966
      HP = 6076. * PERIGE                                                  010975      16
      A=HP+HE                                                              NASA      3968
      A32=A**1.5                                                           NASA      3969
      HEDA=HE/A                                                            NASA      3970
      S = 1.02 * ASIN(HEDA)                                                101574      29
      N=SQRT(MU)/A32                                                       NASA      3972
      TEOTS=S/(PIE-S)                                                      NASA      3973
      TE=2.*S/N                                                            NASA      3974
      RFD=.01*OPTEMP+1.0                                                   NASA      3975
      DO 10 I=1,5                                                          NASA      3976
   10 ICHOSE(I)=0                                                          NASA      3977
      IERR=0                                                               NASA      3978
C *   LMBDD MUST GO TO REL                                                 NASA      3979
      NB=2                                                                 NASA      3980
      DO 20 I=1,5                                                          NASA      3981
   20 NCHOSE(I)=0                                                          NASA      3982
      NLR=2                                                                NASA      3983
      WATE=0.0                                                             NASA      3984
      AREA=0.0                                                             NASA      3985
C                                                                          NASA      3986
C                                                                          NASA      3987
C                                                                          NASA      3988
C     **  SET UP DELTA-R AND DELTA-T (RADIATION DEGRADATION AND            NASA      3989
C                                    TEMPERATURE CORRECTION FACTORS)       NASA      3990
      DELR=.05                                                             NASA      3991
      IF (ALT.GT.400.) DELR=.3                                             NASA      3992
C                                                                          NASA      3993
C                                                                          NASA      3994
C                                                                          NASA      3995
      IF (ALT.GT.5000.) GO TO 80                                           NASA      3996
      ICONF=NCONF(5)                                                       NASA      3997
      GO TO (30,50,30,50,30,50), ICONF                                     NASA      3998
   30 ICONF=NCONF(1)                                                       NASA      3999
      GO TO (50,50,40,40,40), ICONF                                        NASA      4000
C                                                                          NASA      4001
   40 DELT=.11                                                             NASA      4002
      GO TO 140                                                            NASA      4003
C                                                                          NASA      4004
C                                                                          NASA      4005
   50 ICONF=NCONF(1)                                                       NASA      4006
      GO TO (60,60,70,70,70), ICONF                                        NASA      4007
C                                                                          NASA      4008
   60 DELT=.01                                                             NASA      4009
      GO TO 140                                                            NASA      4010
C                                                                          NASA      4011
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 70     DELT=.04                                                         NASA      4012
        GO TO 140                                                        NASA      4013
C                                                                        NASA      4014
C **    ALTITUDE IS GREATER THAN 5000 NAUTICAL MILES  **                 NASA      4015
C                                                                        NASA      4016
 80     ICONF=NCONF(5)                                                   NASA      4017
        GO TO (90,110,90,110,90,110), ICONF                              NASA      4018
C                                                                        NASA      4019
 90     ICONF=NCONF(1)                                                   NASA      4020
        GO TO (140,140,100,100,100), ICONF                               NASA      4021
C                                                                        NASA      4022
 100    DELT=.08                                                         NASA      4023
        GO TO 140                                                        NASA      4024
C                                                                        NASA      4025
 110    ICONF=NCONF(1)                                                   NASA      4026
        GO TO (120,120,130,130,130), ICONF                               NASA      4027
C                                                                        NASA      4028
 120    DELT=-.05                                                        NASA      4029
        GO TO 140                                                        NASA      4030
C                                                                        NASA      4031
 130    DELT=.02                                                         NASA      4032
C                                                                        NASA      4033
C                                                                        NASA      4034
C ******************************************************************** NASA      4035
C *     NOW WE WILL BE DOING THE EPR MACRO SELECTION (S,SANOD,SLR)     NASA      4036
C ******************************************************************** NASA      4037
C                                                                        NASA      4038
 140    ICONF=NCONF(5)                                                   NASA      4039
        GO TO (150,150,280,280,450,450), ICONF                           NASA      4040
C                                                                        NASA      4041
C                                                                        NASA      4042
C       ** SHUNT REGULATION DESIGN **                                    NASA      4043
C                                                                        NASA      4044
 150    ICONF=NCONF(5)                                                   NASA      4045
        ISR1E=IDB(1)                                                     NASA      4046
        ICELLE=IDB(2)                                                    NASA      4047
        ICHGRE=IDB(3)                                                    NASA      4048
        IPCUE=IDB(12)                                                    NASA      4049
C                                                                        NASA      4050
        IF (IPIC(1).NE.0) GO TO 160                                      NASA      4051
        ISR1=1                                                           NASA      4052
        ICELL=IDB(1)+1                                                   NASA      4053
        ICHGR=IDB(2)+1                                                   NASA      4054
        IPCU=IDB(11)+1                                                   NASA      4055
        NPCU=1                                                           NASA      4056
        ETAE=0.65                                                        NASA      4057
        ETAC=1.0                                                         NASA      4058
        ETAD=1.0                                                         NASA      4059
        ETAR=1.0                                                         NASA      4060
        GO TO 210                                                        NASA      4061
C                                                                        NASA      4062
 160    IF (ITER.EQ.0) GO TO 170                                         NASA      4063
        ISR1=IPIC(1)                                                     NASA      4064
        ICELL=IPIC(2)                                                    NASA      4065
        ICHGR=IPIC(3)                                                    NASA      4066
        GO TO 210                                                        NASA      4067
C                                                                        NASA      4068
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 170   IF (ISR1.GE.ISR1E) GO TO 180                                NASA   4069
       ISR1=IPIC(1)+1                                              NASA   4070
       ICELL=IPIC(2)                                               NASA   4071
       ICHGR=IPIC(3)                                               NASA   4072
       GO TO 210                                                   NASA   4073
C                                                                  NASA   4074
 180   IF (ICELL.GE.ICELLE) GO TO 190                              NASA   4075
       ISR1=1                                                      NASA   4076
       ICELL=IPIC(2)+1                                             NASA   4077
       ICHGR=IPIC(3)                                               NASA   4078
       GO TO 210                                                   NASA   4079
C                                                                  NASA   4080
 190   IF (ICHGR.GE.ICHGRE) GO TO 200                              NASA   4081
       ISR1=1                                                      NASA   4082
       ICELL=IDB(1)+1                                              NASA   4083
       ICHGR=IPIC(3)+1                                             NASA   4084
       GO TO 210                                                   NASA   4085
C                                                                  NASA   4086
 200   ICHOSE(1)=-1                                                NASA   4087
       ICHOSE(2)=-1                                                NASA   4088
       ICHOSE(3)=-1                                                NASA   4089
       RETURN                                                      NASA   4090
C                                                                  NASA   4091
C                                                                  NASA   4092
C  **  COMPUTE SELECTION PARAMETERS FOR SHUNT REGULATION DESIGN - - NASA   4093
C  **  THIS IS FOR SHUNT REGULATOR,BATTERY AND BATTERY CHARGER - -  NASA   4094
C                                                                  NASA   4095
C                                                                  NASA   4096
C                                                                  NASA   4097
C  **  DETERMINE NUMBER OF SHUNT REGULATORS REQUIRED               NASA   4098
C                                                                  NASA   4099
 210   NSR=1                                                       NASA   4100
C      ** DETERMINE EXCESS ARRAY POWER FOR REGULATION              NASA   4102
C                                                                  NASA   4103
  220 PS = (PL/ETAR)*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))              012075   11
C                                                                  NASA   4105
      PBOL=PS/((1.-DELR)*(1.-DELF)*(1.-DELT)*(1-DELI)*(1-DELM))    NASA   4106
C                                                                  NASA   4107
      PEXCES=PBOL-FLMIN                                            NASA   4108
      CAPMAX = 0.0                                                 012075   12
      IF (PEXCES .GE. 720.) CAPMAX = 120.                          012075   13
      IF (PEXCES .GE.1440.) CAPMAX = 240.                          012075   14
C                                                                  NASA   4109
      IF (FLMIN.GE.PEXCES) GO TC 230                               NASA   4110
      NSR =  PEXCES        / DATAB(6,ISR1) + 0.9                   012075   15
      IF (NSR.LE.0) NSR=1                                          NASA   4112
 230  CONTINUE                                                     NASA   4113
C                                                                  NASA   4114
C  **  NOTE - - ADD SPECIAL EQUIPMENT (AS NECESSARY)               NASA   4115
C                                                                  NASA   4116
C                                                                  NASA   4117
C  **  SET VOLTAGES FOR THIS DESIGN                                NASA   4118
C                                                                  NASA   4119
      VDB=27.                                                      NASA   4120
      VBM=25.                                                      NASA   4121
C                                                                  NASA   4122
C  **  BATTERY ALGORITHM                                           NASA   4123
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      C                                                                     NASA      4124
      C        DETERMINE REQUIRED CAPACITIES                                NASA      4125
      C                                                                     NASA      4126
            CR=(PL*TE/3600.)/(LMBDD*ETAD)                                   NASA      4127
            IF (CR .LT. 2300.0) GO TO 238                                   032475      13
            NB = 4                                                          032475      14
            IF (CR .LT. 4700.0) GO TO 238                                   032475      15
            NB = 6                                                          032475      16
            IF (CR .LT. 7050.0) GO TO 238                                   032475      17
            NB = 8                                                          032475      18
            IF (CR .LT. 9400.0) GO TO 238                                   032475      19
            NB = 10                                                         032475      20
        238 NB = AMAX0(NB,NCHOSE(2))                                        032475      21
            CA=CR/VDB                                                       NASA      4128
      C                                                                     NASA      4129
      C        DETERMINE MINIMUM INSTALLED CAPACITY                         NASA      4130
      C                                                                     NASA      4131
            CI=CA*RFD                                                       NASA      4132
      C                                                                     NASA      4133
      C **  DETERMINE NUMBER OF CELLS IN SERIES(TO BE SUPPLIED TO REL)      NASA      4134
      C                                                                     NASA      4135
            NC=VBM/VC                                                       NASA      4136
      C                                                                     NASA      4137
      C     DETERMINE SELECTION PARAMETERS ON CELLS                         NASA      4138
            CISTAR=CI/NB                                                    NASA      4140
      C                                                                     NASA      4141
      C                                                                     NASA      4142
      C *   DETERMINE CHARGE CURRENT RATING REQUIRED FOR THE BATTERY CHARGER * NASA   4143
            CCELL=CISTAR                                                    NASA      4144
            ICH=CCELL/CHMINT                                                NASA      4145
      C                                                                     NASA      4146
      C                                                                     NASA      4147
      C **                                                                  NASA      4148
      C **  COMPARE THE HARDWARE PARAMETER TO THE SELECTION PARAMETER     ** NASA      4149
      C **                                                                  NASA      4150
            IF (DATAB(6,ISR1).GE.CAPMAX.AND.DATAB(6,ICELL).GE.CISTAR.AND.DATAB NASA   4151
           1(6,ICHGR).GE.ICH) GO TO 270                                     NASA      4152
      C                                                                     NASA      4153
            IF (ISR1.GE.ISR1E) GO TO 240                                    NASA      4154
            ISR1=ISR1+1                                                     NASA      4155
            GO TO 220                                                       NASA      4156
      C                                                                     NASA      4157
      240   IF (ICELL.GE.ICELLE) GO TO 250                                  NASA      4158
            ISR1=1                                                          NASA      4159
            ICELL=ICELL+1                                                   NASA      4160
            GO TO 220                                                       NASA      4161
      C                                                                     NASA      4162
      250   IF (ICHGR.GE.ICHGRE) GO TO 260                                  NASA      4163
            ISR1=1                                                          NASA      4164
            ICELL=IDB(1)+1                                                  NASA      4165
            ICHGR=ICHGR+1                                                   NASA      4166
            GO TO 220                                                       NASA      4167
      C                                                                     NASA      4168
      260   ICHOSE(1)=-1                                                    NASA      4169
            ICHOSE(2)=-1                                                    NASA      4170
            ICHOSE(3)=-1                                                    NASA      4171
            RETURN                                                          NASA      4172
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C                                                                               NASA    4173
C                                                                               NASA    4174
270   VCELL=DATAB(24,ICELL)                                                     NASA    4175
      WCELL=DATAB(23,ICELL)                                                     NASA    4176
      ETAE=DATAB(7,ICELL)                                                       NASA    4177
C                                                                               NASA    4178
      WB=NC*WCELL*K2                                                            NASA    4179
      VB=NC*VCELL*K1                                                            NASA    4180
C                                                                               NASA    4181
      WBT=WB*NB                                                                 NASA    4182
      VBT=VB*NB                                                                 NASA    4183
C                                                                               NASA    4184
      BATCAP=NB*DATAB(6,ICELL)                                                  NASA    4185
      ETAC=DATAB(7,ICHGR)                                                       NASA    4186
      NCH=NB                                                                    NASA    4187
C                                                                               NASA    4188
C                                                                               NASA    4189
      IF (NCHOSE(1) .GE. NSR) GO TO 271                                         NASA    4190
      NCHOSE(1)=NSR                                                             NASA    4191
  271 IF (NCHOSE(2) .GE. NB) GO TO 272                                          NASA    4192
      NCHOSE(2)=NB                                                              NASA    4193
  272 IF (NCHOSE(3) .GE. NCH) GO TO 273                                         NASA    4194
      NCHOSE(3)=NCH                                                             NASA    4195
  273 IF (NCHOSE(4) .GE. NPCU) GO TO 274                                        NASA    4196
      NCHOSE(4)=NPCU                                                            NASA    4197
  274 NCHOSE(5)=0                                                               NASA    4198
C                                                                               NASA    4199
      ICHOSE(1)=DATAB(1,ISR1)                                                   NASA    4200
      ICHOSE(2)=DATAB(1,ICELL)                                                  NASA    4201
      ICHOSE(3)=DATAB(1,ICHGR)                                                  NASA    4202
      ICHOSE(4)=DATAB(1,IPCU)                                                   NASA    4203
      ICHOSE(5)=0                                                               NASA    4204
C                                                                               NASA    4205
      IPIC(1)=ISR1                                                              NASA    4206
      IPIC(2)=ICELL                                                             NASA    4207
      IPIC(3)=ICHGR                                                             NASA    4208
      IPIC(4)=IPCU                                                              NASA    4209
      IPIC(5)=0                                                                 NASA    4210
C                                                                               NASA    4211
C                                                                               NASA    4212
      WT=NSR*DATAB(23,ISR1)+WBT+NCH*DATAB(23,ICHGR)+NPCU*DATAB(23,IPCU)         NASA    4213
     * +WT                                                                      NASA    4214
C                                                                               NASA    4215
      VOL=NSR*DATAB(24,ISR1)+VBT+NCH*DATAB(24,ICHGR)+NPCU*DATAB(24,IPCU)        NASA    4216
     * +VOL                                                                     NASA    4217
C                                                                               NASA    4218
      GO TO 590                                                                 NASA    4219
C                                                                               NASA    4220
C                                                                               NASA    4221
C     ** SHUNT AND DISCHARGE DESIGN **                                          NASA    4222
C                                                                               NASA    4223
280   ICONF=NCCNF(5)                                                            NASA    4224
      IDRE=IDB(4)                                                               NASA    4225
      ISR2E=IDB(5)                                                              NASA    4226
      ICELLE=IDB(2)                                                             NASA    4227
      ICHGRE=IDB(6)                                                             NASA    4228
      NCCU=1                                                                    NASA    4229
```

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C                                                                       NASA  4230
      IF (IPIC(1).NE. 0) GO TO 290                                      NASA  4231
      IDR=IDB(3)+1                                                      NASA  4232
      ISR2=IDB(4)+1                                                     NASA  4233
      ICELL=IDB(1)+1                                                    NASA  4234
      ICHGR=IDB(5)+1                                                    NASA  4235
      ICCU=IDB(6)+1                                                     NASA  4236
      ETAD=0.85                                                         NASA  4237
      ETAC=1.0                                                          NASA  4238
      ETAE=0.65                                                         NASA  4239
      ETAR=1.0                                                          NASA  4240
      GO TO 360                                                         NASA  4241
C                                                                       NASA  4242
290   IF (ITER.EQ.0) GO TO 300                                          NASA  4243
      IDR=IPIC(1)                                                       NASA  4244
      ISR2=IPIC(2)                                                      NASA  4245
      ICELL=IPIC(3)                                                     NASA  4246
      ICHGR=IPIC(4)                                                     NASA  4247
      ICCU=IPIC(5)                                                      NASA  4248
      GO TO 360                                                         NASA  4249
C                                                                       NASA  4250
300   IF (IDR.GE.IDRE) GO TO 310                                        NASA  4251
      IDR=IPIC(1)+1                                                     NASA  4252
      ISR2=IPIC(2)                                                      NASA  4253
      ICELL=IPIC(3)                                                     NASA  4254
      ICHGR=IPIC(4)                                                     NASA  4255
      ICCU=IPIC(5)                                                      NASA  4256
      GO TO 360                                                         NASA  4257
C                                                                       NASA  4258
310   IF (ISR2.GE.ISR2E) GO TO 320                                      NASA  4259
      IDR=IDB(3)+1                                                      NASA  4260
      ISR2=IPIC(2)+1                                                    NASA  4261
      ICELL=IPIC(3)                                                     NASA  4262
      ICHGR=IPIC(4)                                                     NASA  4263
      ICCU=IPIC(5)                                                      NASA  4264
      GO TO 360                                                         NASA  4265
C                                                                       NASA  4266
320   IF (ICELL.GE.ICELLE) GO TO 330                                    NASA  4267
      IDR=IDB(3)+1                                                      NASA  4268
      ISR2=IDB(4)+1                                                     NASA  4269
      ICELL=IPIC(3)+1                                                   NASA  4270
      ICHGR=IPIC(4)                                                     NASA  4271
      ICCU=IPIC(5)                                                      NASA  4272
      GO TO 360                                                         NASA  4273
C                                                                       NASA  4274
330   IF (ICHGR.GE.ICHGRE) GO TO 340                                    NASA  4275
      IDR=IDB(3)+1                                                      NASA  4276
      ISR2=IDB(4)+1                                                     NASA  4277
      ICELL=IDB(1)+1                                                    NASA  4278
      ICHGR=IPIC(4)+1                                                   NASA  4279
      ICCU=IPIC(5)                                                      NASA  4280
      GO TO 360                                                         NASA  4281
C                                                                       NASA  4282
340   DO 350 I=1,5                                                      NASA  4283
350   ICHOSE(I)=-1                                                      NASA  4284
      RETURN                                                            NASA  4285
C                                                                       NASA  4286
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C                                                                       NASA      4287
C **   COMPUTE SELECTION PARAMETERS FOR SHUNT AND DISCHARGE REGULATION - NASA      4288
C **   THIS IS FOR DISCHARGE REGULATOR,SHUNT REGULATOR,BATTERY,BATTERY   NASA      4289
C **.  CHARGER AND SIZING THE CENTRAL CONTROL UNIT - -                   NASA      4290
C                                                                       NASA      4291
C **   DETERMINE NUMBER OF DISCHARGE REGULATORS REQUIRED                 NASA      4292
C                                                                       NASA      4293
360    ND=NB                                                            NASA      4294
C                                                                       NASA      4295
C      ** DETERMINE EXCESS ARRAY POWER FOR REGULATION                    NASA      4296
C                                                                       NASA      4297
       PS=(PL/ETAR)*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))                    NASA      4298
       PBOL=PS/((1.-DELR)*(1.-DELF)*(1.-DELT)*(1-DELI)*(1-DELM))        NASA      4299
C                                                                       NASA      4300
       PEXCES=PBOL-PLMIN                                                NASA      4301
C                                                                       NASA      4302
       IF (ITER .GE. 1 .AND. NCHOSE(1) .GE. ND) ND=NCHOSE(1)            NASA      4303
       PD=PL/(ND*ETAD)                                                  NASA      4304
C                                                                       NASA      4305
C **   DETERMINE NUMBER OF SHUNT REGULATORS REQUIRED                     NASA      4306
C                                                                       NASA      4307
  370  CAPMAX = 0.0                                                     012075      16
       IF (PEXCES .GE. 720.) CAPMAX = 120.                              012075      17
       IF (PEXCES .GE.1440.) CAPMAX = 240.                              012075      18
       NSR=1                                                            NASA      4309
       IF (PLMIN.GE.PEXCES) GO TO 380                                   NASA      4310
       NSR =  PEXCES         / DATAB(6,ISR2) + 0.9                      012075      19
       IF (NSR.LE.0) NSR=1                                              NASA      4312
380    CONTINUE                                                         NASA      4313
C                                                                       NASA      4314
C **   SET VOLTAGES FOR SHUNT AND DISCHARGE DESIGN                       NASA      4315
C                                                                       NASA      4316
       VDB=21.                                                          NASA      4317
       VBM=19.                                                          NASA      4318
C                                                                       NASA      4319
C **   SET UP BATTERY SELECTION PARAMETER                                NASA      4320
C                                                                       NASA      4321
C          DETERMINE REQUIRED CAPACITIES                                 NASA      4322
C                                                                       NASA      4323
       CR=(PL*TE/3600.)/(LMBDD*ETAD)                                    NASA      4324
       IF (CR .LT. 1827.0) GO TO 322                                    032475      22
       NB = 4                                                           032475      23
       IF (CR .LT. 3654.0) GO TO 322                                    032475      24
       NB = 6                                                           032475      25
       IF (CR .LT. 5481.0) GO TO 322                                    032475      26
       NB = 8                                                           032475      27
       IF (CR .LT. 7308.0) GO TO 322                                    032475      28
       NB = 10                                                          032475      29
  322  NB = AMAX0(NB,NCHOSE(3))                                         032475      30
       CA=CR/VDB                                                        NASA      4325
C                                                                       NASA      4326
C          DETERMINE MINIMUM INSTALLED CAPACITY                          NASA      4327
C                                                                       NASA      4328
       CI=CA*RFO                                                        NASA      4329
C                                                                       NASA      4330
C          DETERMINE NUMBER OF CELLS IN SERIES(TO BE SUPPLIED TO REL)    NASA      4331
C                                                                       NASA      4332
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      NC=VBM/VC                                                         NASA      4333
C                                                                       NASA      4334
C            CISTAR IS SELECTION PARAMETER ON CELLS                     NASA      4335
C                                                                       NASA      4336
      CISTAR=CI/NB                                                      NASA      4338
C                                                                       NASA      4339
C **  CHARGER SELECTION                                                 NASA      4340
C                                                                       NASA      4341
C *   DETERMINE CHARGE CURRENT RATING REQUIRED FOR THE BATTERY CHARGER * NASA     4342
C                                                                       NASA      4343
      CCELL=CISTAR                                                      NASA      4344
      ICH=CCELL/CHMINT                                                  NASA      4345
C                                                                       NASA      4346
C **                                                                    NASA      4347
C **                                                                    NASA      4348
C **  COMPARE THE HARDWARE PARAMETER TO THE SELECTION PARAMETER      ** NASA      4349
C **                                                                    NASA      4350
C **                                                                    NASA      4351
C                                                                       NASA      4352
      IF (DATAB(6,IDR).GE.PD.AND.DATAB(6,ISR2).GE.CAPMAX.AND.DATAB(6,ICE NASA     4353
     1LL).GE.CISTAR.AND.DATAB(6,ICHGR).GE.ICH) GO TO 440                NASA      4354
C                                                                       NASA      4355
      IF (IDR.GE.IDRE) GO TO 390                                        NASA      4356
      IDR=IDR+1                                                         NASA      4357
      GO TO 370                                                         NASA      4358
C                                                                       NASA      4359
390   IF (ISR2.GE.ISR2E) GO TO 400                                      NASA      4360
      IDR=IDB(3)+1                                                      NASA      4361
      ISR2=ISR2+1                                                       NASA      4362
      GO TO 370                                                         NASA      4363
C                                                                       NASA      4364
400   IF (ICELL.GE.ICELLE) GO TO 410                                    NASA      4365
      IDR=IDB(3)+1                                                      NASA      4366
      ISR2=IDB(4)+1                                                     NASA      4367
      ICELL=ICELL+1                                                     NASA      4368
      GO TO 370                                                         NASA      4369
C                                                                       NASA      4370
410   IF (ICHGR.GE.ICHGRE) GO TO 420                                    NASA      4371
      IDR=IDB(3)+1                                                      NASA      4372
      ISR2=IDB(4)+1                                                     NASA      4373
      ICELL=IDB(1)+1                                                    NASA      4374
      ICHGR=ICHGR+1                                                     NASA      4375
      GO TO 370                                                         NASA      4376
C                                                                       NASA      4377
420   DO 430 I=1,5                                                      NASA      4378
430   ICHOSE(I)=-1                                                      NASA      4379
      RETURN                                                            NASA      4380
C                                                                       NASA      4381
C                                                                       NASA      4382
440   ETAD=DATAB(7,IDR)                                                 NASA      4383
      ETAE=DATAB(7,ICELL)                                               NASA      4384
      ETAC=DATAB(7,ICHGR)                                               NASA      4385
      VCELL=DATAB(24,ICELL)                                             NASA      4386
      WCELL=DATAB(23,ICELL)                                             NASA      4387
      WB=NC*WCELL*K2                                                    NASA      4388
      VB=NC*VCELL*K1                                                    NASA      4389
      WBT=WB*NB                                                         NASA      4390
```

```
            VBT=VB*NB
            NCH=NB
            BATCAP=NB*DATAB(6,ICELL)
      C
            ICHOSE(1)=DATAB(1,IDR)
            ICHOSE(2)=DATAB(1,ISR2)
            ICHOSE(3)=DATAB(1,ICELL)
            ICHOSE(4)=DATAB(1,ICHGR)
            ICHOSE(5)=DATAB(1,ICCU)
      C
            IF (NCHOSE(1) .GE. ND) GO TO 451
            NCHOSE(1)=ND
        451 IF (NCHOSE(2) .GE. NSR) GO TO 452
            NCHOSE(2)=NSR
        452 IF (NCHOSE(3) .GE. NB) GO TO 453
            NCHOSE(3)=NB
        453 IF (NCHOSE(4) .GE. NCH) GO TO 454
            NCHOSE(4)=NCH
        454 IF (NCHOSE(5) .GE. NCCU) GO TO 455
            NCHOSE(5)=NCCU
      C **
        455 IPIC(1)=IDR
            IPIC(2)=ISR2
            IPIC(3)=ICELL
            IPIC(4)=ICHGR
            IPIC(5)=ICCU
      C
      C
            WT=ND*DATAB(23,IDR)+NSR*DATAB(23,ISR2)+WBT+NCH*DATAB(23,ICHGR)+
           * NCCU*DATAB(23,ICCU)+WT
      C
            VOL=ND*DATAB(24,IDR)+NSR*DATAB(24,ISR2)+VBT+NSR*DATAB(24,ICHGR)+
           * NCCU*DATAB(24,ICCU)+VOL
      C
            GO TO 590
      C
      C
      C     ** SERIES LOAD REGULATION DESIGN
      C
      C
      450   ICONF=NCONF(5)
            ILRE=IDB(8)
            ICELLE=IDB(2)
            ICHGRE=IDB(9)
            ISPDE=IDB(10)
            IPDE=IDB(11)
      C
            IF (IPIC(1).NE.0) GO TO 460
            ILR=IDB(7)+1
            ICELL=IDB(1)+1
            ICHGR=IDB(8)+1
            ISPD=IDB(9)+1
            IPD=IDB(10)+1
            ETALR=0.9
            ETAE=0.65
            ETAC=1.0
            ETAD=1.0
            NSPD=1
```

```
      NPD=1                                                             NASA      4448
      GO TO 520                                                         NASA      4449
C                                                                       NASA      4450
  460 IF (ITER.EQ.0) GO TO 470                                          NASA      4451
      ILR=IPIC(1)                                                       NASA      4452
      ICELL=IPIC(2)                                                     NASA      4453
      ICHGR=IPIC(3)                                                     NASA      4454
      ISPD=IPIC(4)                                                      NASA      4455
      IPD=IPIC(5)                                                       NASA      4456
      GO TO 520                                                         NASA      4457
C                                                                       NASA      4458
  470 IF (ILR.GE.ILRE) GO TO 480                                        NASA      4459
      ILR=IPIC(1)+1                                                     NASA      4460
      ICELL=IPIC(2)                                                     NASA      4461
      ICHGR=IPIC(3)                                                     NASA      4462
      ISPD=IPIC(4)                                                      NASA      4463
      IPD=IPIC(5)                                                       NASA      4464
      GO TO 520                                                         NASA      4465
C                                                                       NASA      4466
  480 IF (ICELL.GE.ICELLE) GO TO 490                                    NASA      4467
      ILR=IDB(7)+1                                                      NASA      4468
      ICELL=IPIC(2)+1                                                   NASA      4469
      ICHGR=IPIC(3)                                                     NASA      4470
      ISPD=IPIC(4)                                                      NASA      4471
      IPD=IPIC(5)                                                       NASA      4472
      GO TO 520                                                         012875       1
C                                                                       NASA      4473
  490 IF (ICHGR.GE.ICHGRE) GO TO 500                                    NASA      4474
      ILR=IDB(7)+1                                                      NASA      4475
      ICELL=IDB(1)+1                                                    NASA      4476
      ICHGR=IPIC(3)+1                                                   NASA      4477
      ISPD=IPIC(4)                                                      NASA      4478
      IPD=IPIC(5)                                                       NASA      4479
      GO TO 520                                                         012875       2
C                                                                       NASA      4480
  500 DO 510 I=1,5                                                      NASA      4481
  510 ICHOSE(I)=-1                                                      NASA      4482
      RETURN                                                            NASA      4483
C                                                                       NASA      4484
C                                                                       NASA      4485
C **  COMPUTE SELECTION PARAMETERS FOR SERIES LOAD REGULATION           NASA      4486
C **  THIS IS FOR THE LOAD REGULATOR,BATTERY,BATTERY CHARGER AND        NASA      4487
C **  SIZING THE SOLAR POWER DISTRIBUTOR AND POWER DISTRIBUTOR          NASA      4488
C                                                                       NASA      4489
C                                                                       NASA      4490
C           NLR IS THE NUMBER OF LOAD REGULATORS REQUIRED               NASA      4491
  520 NLR=2                                                             NASA      4492
C                                                                       NASA      4493
C     ** DETERMINE EXCESS ARRAY POWER FOR REGULATION                    NASA      4494
C                                                                       NASA      4495
      PS=(PL/ETAR)*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))                     NASA      4496
      PBOL=PS/((1.-DELR)*(1.-DELF)*(1.-DELT)*(1-DELI)*(1-DELM))         NASA      4497
C                                                                       NASA      4498
      PEXCES=PBOL-PLMIN                                                 NASA      4499
C                                                                       NASA      4500
C                                                                       NASA      4501
C           DETERMINE SELECTION PARAMETERS FOR LOAD REGULATORS          NASA      4502
```

```
C                                                                          NASA    4503
      IF (ITER .GE. 1 .AND. NCHOSE(1) .GE. NLR) NLR=NCHOSE(1)            NASA    4504
      FLR=PL/(ETALR*NLR)                                                 NASA    4505
C                                                                        NASA    4506
C         SET VOLTAGES FOR THIS DESIGN                                   NASA    4507
C                                                                        NASA    4508
      VDB=27.                                                            NASA    4509
      VBM=23.                                                            NASA    4510
C                                                                        NASA    4511
C **  SET UP BATTERY SELECTION PARAMETERS                                NASA    4512
C                                                                        NASA    4513
C         DETERMINE REQUIRED CAPACITIES                                  NASA    4514
C                                                                        NASA    4515
      CR=(PL*TE/3600.)/(LMBDD*ETAD)                                      NASA    4516
      IF (CR .LT. 2300.0) GO TO 522                                      032475    31
      NB = 4                                                             032475    32
      IF (CR .LT. 4700.0) GO TO 522                                      032475    33
      NB = 6                                                             032475    34
      IF (CR .LT. 7050.0) GO TO 522                                      032475    35
      NB = 8                                                             032475    36
      IF (CR .LT. 9400.0) GO TO 522                                      032475    37
      NB = 10                                                            032475    38
  522 NB = AMAX0(NB,NCHOSE(2))                                           032475    39
      CA=CR/VDB                                                          NASA    4517
C                                                                        NASA    4518
C         DETERMINE MINIMUM INSTALLED CAPACITY                           NASA    4519
C                                                                        NASA    4520
      CI=CA*RFD                                                          NASA    4521
C                                                                        NASA    4522
C         DETERMINE NUMBER OF CELLS IN SERIES(TO BE SUPPLIED TO REL)     NASA    4523
C                                                                        NASA    4524
      NC=VBM/VC                                                          NASA    4525
C                                                                        NASA    4526
C         CISTAR IS SELECTION PARAMETERS ON CELLS                        NASA    4527
C                                                                        NASA    4528
      CISTAR=CI/NB                                                       NASA    4530
C                                                                        NASA    4531
C **      CHARGER SELECTION PARAMETER                                    NASA    4532
C                                                                        NASA    4533
C *   DETERMINE CHARGE CURRENT RATING REQUIRED FOR THE BATTERY CHARGER * NASA    4534
C                                                                        NASA    4535
      CCELL=CISTAR                                                       NASA    4536
      ICH=CCELL/CHMINT                                                   NASA    4537
C                                                                        NASA    4538
C **                                                                     NASA    4539
C **                                                                     NASA    4540
C **  COMPARE THE HARDWARE PARAMETER TO THE SELECTION PARAMETER       ** NASA    4541
C **                                                                     NASA    4542
C **                                                                     NASA    4543
C                                                                        NASA    4544
  530 IF (DATAB(6,ILR).GE.PLR.AND.DATAB(6,ICELL).GE.CISTAR.AND.DATAB(6,I NASA    4545
     1CHGR).GE.ICH) GO TO 580                                            NASA    4546
C                                                                        NASA    4547
C                                                                        NASA    4548
      IF (ILR.GE.ILRE) GO TO 540                                         NASA    4549
      ILR=ILR+1                                                          NASA    4550
      GO TO 530                                                          NASA    4551
```

```
C
540   IF (ICELL.GE.ICELLE) GO TO 550
      ILR=IDB(7)+1
      ICELL=ICELL+1
      GO TO 530
C
550   IF (ICHGR.GE.ICHGRE) GO TO 560
      ILR=IDB(7)+1
      ICELL=IDB(1)+1
      ICHGR=ICHGR+1
      GO TO 530
C
560   DO 570 I=1,5
570   ICHOSE(I)=-1
      RETURN
C
C
580   ETALR=DATAB(7,ILR)
      ETAR=ETALR
      PLRD=PL*(1./ETALR-1.)
      ETAE=DATAB(7,ICELL)
      ETAC=DATAB(7,ICHGR)
      VCELL=DATAB(24,ICELL)
      WCELL=DATAB(23,ICELL)
      WB=NC*WCELL*K2
      VB=NC*VCELL*K1
      WBT=WB*NB
      VBT=VB*NB
      NCH=NB
      BATCAP=NB*DATAB(6,ICELL)
C
      ICHOSE(1)=DATAB(1,ILR)
      ICHOSE(2)=DATAB(1,ICELL)
      ICHOSE(3)=DATAB(1,ICHGR)
      ICHOSE(4)=DATAB(1,ISPD)
      ICHOSE(5)=DATAB(1,IPD)
C
      IF (NCHOSE(1) .GE. NLR) GO TO 581
      NCHOSE(1)=NLR
  581 IF (NCHOSE(2) .GE. NB) GO TO 582
      NCHOSE(2)=NB
  582 IF (NCHOSE(3) .GE. NCH) GO TO 583
      NCHOSE(3)=NCH
  583 IF (NCHOSE(4) .GE. NSPD) GO TO 584
      NCHOSE(4)=NSPD
  584 IF (NCHOSE(5) .GE. NPD) GO TO 585
      NCHOSE(5)=NPD
C
  585 IPIC(1)=ILR
      IPIC(2)=ICELL
      IPIC(3)=ICHGR
      IPIC(4)=ISPD
      IPIC(5)=IPD
C
C
C
      WT=NLR*DATAB(23,ILR)+WBT+NCH*DATAB(23,ICHGR)+NSPD*DATAB(23,ISPD)+
```

```
     * NPD*DATAB(23,IPC)+WT
C
      VOL=NLR*DATAB(24,ILR)+VBT+NCH*DATAB(24,ICHGR)+NSPD*DATAB(24,ISPD)
     * +NPD*DATAB(24,IPD)+VOL
C
C
C     ** SOLAR ARRAY SIZING
C
C
590   ICONF=NCONF(5)
      POCNWT=WT-WTIN-WBT
      GO TO (600,610,600,610,600,610), ICONF
C
C     **  ORIENTED PADDLE SOLAR ARRAY (NON-SPINNING)
C
600   FW=7.3
      LMBDG=1.
      GO TO 670
C
C
C
610   ICONF=NCONF(6)
      GO TO (630,620,650), ICONF
C
C     **  BODY MOUNTED, BOX SHAPE, NON-SPINNING
C
620   FW=3.4
      LMBDG=1.
      GO TO 670
C
C
C
630   ICONF=NCONF(1)
      IF (ICONF .GE. 3) GO TO 640
C
C     ** BODY MOUNTED CYLINDER SPINNING
C
      FW=3.4
      LMBDG=1./PIE
      GO TO 670
C
C     ** BODY MOUNTED CYLINDER NON-SPINNING
C
640   FW=3.4
      LMBDG=2./PIE
      GO TO 670
C
C
C
650   ICONF=NCONF(1)
      IF (ICCNF .GE. 3) GO TO 660
C
C     ** BODY MOUNTED SPHERE  SPINNING
C
      FW=3.4
      LMBDG=.25
      GO TO 670
```

```
C
C     ** BODY MOUNTED SPHERE NON-SPINNING
C
660   FW=3.4
      LMBDG=.5
C
C         COMPUTE ENERGY BALANCE EQUATION
C
670   PS=PL/ETAR*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))
C
C     COMPUTE SIZING FACTOR
C
      FS=LMBDG*LMBDP*((1.-DELR)*(1.-DELF)*(1.-DELT)*(1.-DELI)*(1.-DELM))
C
C     COMPUTE ARRAY AREA
C
      A1=PS/(FS*SOL*ETAI)
C
C     COMPUTE ARRAY WEIGHT
C
      WATE=A1*FW
C
C     CONVERT TO ENGLISH FROM METRIC
C
      AREA=A1*10.76426265
      WATE=WATE*2.20462
C
      RETURN
C
      END
```

```
      SUBROUTINE AUXPRO (IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)              022875      6
      COMMON /USERI/    APOGEE,     CCMRAT,     DIAMAX, EEQWT(9),     EPME,  022575    533
     1                  EQM1WT,     EQM1XL,     EQM1YL,   EQM1ZL,   EQM2WT,  022575    534
     2                  EQM2XL,     EQM2YL,     EQM2ZL,    TTHST,   IAGNCY,  022575    535
     3         IDEBUG,  ISATOR,     MB12SH,     OPTEMP,   ORBINC,   PERIGE,  022575    536
     4          MICRO,   RELME,    SPEC(6),      SPEC1,    XDUM1,   XCGSA1,  022575    537
     5                    XMER,       XMEU                                   022575    538
C                                                                            022575    539
      COMMON /BTWN/      ACSSN,      ACSWP,        ALT,     AREA,   BATCAP,  022575    540
     1              BITRAT(2),      CLIFE,     CONVWT,        D,       DT,   022575    541
     2                     DX,         DY,         DZ,    EQBLG,   EQBSID,   022575    542
     3                     FC,     ACTHST,     HARNWT,      HPT,   HTPIPE,   022575    543
     4                   HTPT,     HTRPRB,     HTRPWR,             IBTLOC,   022575    544
     5                 LMBDD,         NC,      OMEGS,   PASSTR,       PJ,    022575    545
     6                     PL,      PLMIN,     POCNWT,     RADA,    RADAB,   022575    546
     7                    RAT,         RJ,     SABOLG,    SATLG,   SATTWT,   022575    547
     8                  SATWT,     SATXCG,     SATYCG,   SATZCG,    SA1XL,   022575    548
     9                  SA1YL,      SA1ZL,       SIDE,    SYSLB,   THCMWT,   022575    549
     A                   T(2),     TCTIMP,      TNKWT,    TPRIM,       VB,   022575    550
     B                   VCHP,        VOL,       WATE,       WB,      WBT,   022575    551
     C                     WT,         XJ,     XNZERO,       YJ,       ZJ    022575    552
C                                                                            022575    553
      COMMON /DBCOM/DATAB(55,100),IDB(30)                                    022575    554
C                                                                            022575    555
      COMMON/PRTCOM/    ACCRCY,         AM,         AN,       BF,       BS,  022575    556
     1              CDPI(7,2),     CISTAR,       CTOT,     DDTE,       DE,   022575    557
     2                  DRIWT,     EQBSTR,     FEEINV,   FEEOPS,     FEER,   022575    558
     3                    GSE,       IREL,     ITRUNC,   MMDOLD,NAME(3,60),  022575    559
     4                    CPS,     PAYINV,     PAYQUL,     PAYR,       PE,   022575    560
     5                    PMP,        PMR,   POWER(6),       PU,  PWR(60),   022575    561
     6                    QCP,        QCF,   ROLD(60),   SABMWT,   SATADP,   022575    562
     7                 SATINV,       SATR,       SEIP,     SEIR, SKTAU(6),   022575    563
     8               SSREL(6),    SUBE(7),    SUBT(7), SUBUE(7), SUBUP(7),   022575    564
     9                     TA,   TAU(6,6),         TB,       TC,       TE,   022575    565
     A                     TF,      TOOLR,      TOOLU,   TOTOPS,    TRUNC,   022575    566
     B                     TS,        TTT,  VOLUME(6),  VQL(60),WEIGHT(6),   022575    567
     C                  XLTOT,       XMEH,     XMEINV,     XMEL,    XMEVL,   022575    568
     D                   XMEW,      XMEWT,      XVEST                        022575    569
      DIMENSION IPIC(9),NCONF(6),ICHOSE(14),NCHOSE(14),                      NASA      4705
     * IACCPT(20)                                                            NASA      4706
      DIMENSION N(14)                                                        NASA      4707
      DATA XMR/1.5/                                                          NASA      4708
      PRINT 9000,ACTHST,TTHST                                                022075      13
 9000 FORMAT (1X,9HACTHST = ,E11.4,1X,8HTTHST = ,E11.4)                      022075      14
      DRIWT=0.                                                               111874      58
      IF(NCONF(2).GT.1) GO TO 38                                             NASA      4709
C                                                                            NASA      4710
C     THIS IS COLD GAS CONFIGURATION                                         NASA      4711
C                                                                            NASA      4712
C     DETERMINE MAXIMUM THRUST FROM SANDC                                    NASA      4713
C                                                                            NASA      4714
      FMAX= AMAX1(ACTHST,TTHST)                                              NASA      4715
      IF(FMAX.LT.50..AND.TOTIMP.LT.50000.) GO TO 1                           NASA      4716
C                                                                            NASA      4717
```

```
C     THIS IS NOT AN ACCEPTABLE CONFIGURATION
C
      ICHOSE(1)=-1
      RETURN
C
    1 CONTINUE
C
      IF(ITER.NE.0) GO TO 3
C
C     INITIALIZE ICHOSE, NCHOSE, IERR AND SELECT HARDWARE NOT SIZED
C      I.E., THE FILL AND VENT VALVE AND RELIEF VALVE
      CO 2 I=1,14
      ICHOSE(I)= 0
    2 NCHOSE(I)= 0
      IERR= 0
      NCHOSE(1)=6
      NCHOSE(2)=2
      NCHOSE(3)=4
      NCHOSE(4)=9
      DO 299 I=5,8
  299 NCHOSE(I)=1
C
      II= IDB(5) + 1
      JJ= IDB(6) + 1
      ICHOSE(7) = DATAB(1,II)
      ICHOSE(8) = DATAB(1,JJ)
C
    3 CONTINUE
C
C
C     THRUSTER SELECTION
C
C     FIRST CHECK TO SEE IF THERE IS AN ACCEPTABLE THRUSTER IN THE DATA
C     BASE
C
      J1E= IDB(1)
      J1= 1
   10 THRUST= DATAB(6,J1)
      IF(THRUST.GE.FMAX) GO TO 12
      IF(J1.EQ.J1E) GO TO 11
      J1= J1 + 1
      GO TO 10
C
C     NO ACCEPTABLE THRUSTERS
C
   11 ICHOSE(1)= -1
      RETURN
C
C     AT LEAST ONE ACCEPTAELE THRUSTER
C
   12 CONTINUE
C
C     SELECT PNEUMATIC ATTITUDE AND CONTROL THRUSTERS
C
C     FIRST DETERMINE SET OF ALL THRUSTERS WHICH SATISFY THE INEQUALITY
C     THRUST GE ACTHST
C
```

```
      I= 1                                                              NASA      4775
      J1= 1                                                             NASA      4776
   13 THRUST= DATAB(6,J1)                                               NASA      4777
      IF(THRUST.GE.ACTHST) GO TO 15                                     NASA      4778
   14 IF(J1.EQ.J1E) GO TO 16                                            NASA      4779
      J1= J1 + 1                                                        NASA      4780
      GO TO 13                                                          NASA      4781
   15 IACCPT(I)= J1                                                     NASA      4782
      I= I + 1                                                          NASA      4783
      GO TO 14                                                          NASA      4784
   16 CONTINUE                                                          NASA      4785
      IMAX= I - 1                                                       NASA      4786
C                                                                       NASA      4787
C     CHOOSE THAT THRUSTER FROM THE ABOVE SET WHICH MINIMIZES THE       NASA      4788
C     QUANTITY, ABS(THRUST - ACTHST)                                    NASA      4789
C                                                                       NASA      4790
      I=1                                                               NASA      4791
      J1= IACCPT(I)                                                     NASA      4792
      THRUST= DATAB(6,J1)                                               NASA      4793
      DIFOLD= ABS(THRUST - ACTHST)                                      NASA      4794
   17 ICHOSE(1)= DATAB(1,J1)                                            NASA      4795
      JSAVE=J1                                                          NASA      4796
      IF(I.EQ.IMAX) GO TO 20                                            NASA      4797
   18 I= I + 1                                                          NASA      4798
      J1= IACCPT(I)                                                     NASA      4799
      THRUST= DATAB(6,J1)                                               NASA      4800
      DIFNEW= ABS(THRUST - ACTHST)                                      NASA      4801
      IF(DIFNEW.LE.DIFOLD) GO TO 19                                     NASA      4802
      IF(I.LT.IMAX) GO TO 18                                            NASA      4803
      GO TO 20                                                          NASA      4804
   19 DIFOLD= DIFNEW                                                    NASA      4805
      GO TO 17                                                          NASA      4806
   20 J1=JSAVE                                                          NASA      4807
      T(1)=DATAB(6,J1)                                                  101674       1
C                                                                       NASA      4809
C     SELECT PNEUMATIC TRANSLATIONAL THRUSTERS USING ABOVE PROCEDURE    NASA      4810
C                                                                       NASA      4811
      I= 1                                                              NASA      4812
      J2= 1                                                             NASA      4813
   21 THRUST= DATAB(6,J2)                                               NASA      4814
      IF(THRUST.GE.TTHST) GO TO 23                                      NASA      4815
   22 IF(J2.EQ.J1E) GO TO 24                                            NASA      4816
      J2= J2 + 1                                                        NASA      4817
      GO TO 21                                                          NASA      4818
   23 IACCPT(I)= J2                                                     NASA      4819
      I= I + 1                                                          NASA      4820
      GO TO 22                                                          NASA      4821
   24 CONTINUE                                                          NASA      4822
      IMAX= I - 1                                                       NASA      4823
      I= 1                                                              NASA      4824
      J2= IACCPT(I)                                                     NASA      4825
      THRUST= DATAB(6,J2)                                               NASA      4826
      DIFOLD= ABS(THRUST - TTHST)                                       NASA      4827
   25 ICHOSE(2)= DATAB(1,J2)                                            NASA      4828
      JSAVE=J2                                                          NASA      4829
      IF(I.EQ.IMAX) GO TO 28                                            NASA      4830
   26 I= I + 1                                                          NASA      4831
```

```
      J2= IACCPT(I)                                                     NASA    4832
      THRUST= DATAB(6,J2)                                               NASA    4833
      CIFNEW= ABS(THRUST - TTHST)                                       NASA    4834
      IF(DIFNEW.LE.DIFOLD) GO TO 27                                     NASA    4835
      IF(I.LT.IMAX) GO TO 26                                            NASA    4836
      GO TO 28                                                          NASA    4837
   27 DIFOLD= DIFNEW                                                    NASA    4838
      GO TO 25                                                          NASA    4839
   28 J2=JSAVE                                                          NASA    4840
      T(2)=DATAB(6,J2)                                                  101674     2
C                                                                       NASA    4842
C     THRUSTERS HAVE BEEN SELECTED                                      NASA    4843
C                                                                       NASA    4844
C     SET NUMBER OF EACH TYPE OF THRUSTER                               NASA    4845
C                                                                       NASA    4846
C                                                                       NASA    4847
C                                                                       NASA    4848
C     CHECK TO SEE IF CYCLE LIFE REQUIREMENT IS SATISFIED               NASA    4849
C                                                                       NASA    4850
      IERR= 0                                                           NASA    4851
      IF(DATAB(7,J1).LT.CLIFE) IERR= 1                                  NASA    4852
      IF(DATAB(7,J2).LT.CLIFE) IERR= IERR + 10                          NASA    4853
C                                                                       NASA    4854
C     IERR= 1 IMPLIES THAT THE CYCLE LIFE OF THE ATTITUDE AND CONTROL   NASA    4855
C     THRUSTERS IS TOO SHORT. IERR= 10 IMPLIES THAT THE CYCLE LIFE OF   NASA    4856
C     THE TRANSLATIONAL THRUSTERS IS TOO SHORT. IERR= 11 IMPLIES THAT   NASA    4857
C     THE CYCLE LIVES OF BOTH THRUSTERS ARE TOO SHORT                   NASA    4858
C                                                                       NASA    4859
C     PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC ISOLATION     NASA    4860
C     VALVES AND FILTERS                                                NASA    4861
C                                                                       NASA    4862
      PTI=DATAB(8,J1)                                                   NASA    4863
      RHO= 1.02E-7*PTI                                                  NASA    4864
      WDOTPR= (3.*ACTHST + 2.*TTHST)/65.                                NASA    4865
      CDAISO= WDOTPR/SQRT(200.*RHO/1.29E-3)                             NASA    4866
      RMAX= 200./WDOTPR**2                                              NASA    4867
C                                                                       NASA    4868
C     SET LAST EQUIPMENT INDICES                                        NASA    4869
C                                                                       NASA    4870
      J3E= IDB(2)                                                       NASA    4871
      J4E= IDB(3)                                                       NASA    4872
      J5E= IDB(4)                                                       NASA    4873
      J6E= IDB(5)                                                       NASA    4874
C     DETERMINE HARDWARE INDICES                                        NASA    4875
      DO 30 I=1,9                                                       NASA    4876
      IF(IPIC(I).NE.0) GO TO 31                                         NASA    4877
   30 CONTINUE                                                          NASA    4878
      GO TO 4                                                           NASA    4879
C                                                                       NASA    4880
   31 IF(ITER.NE.0) GO TO 5                                             NASA    4881
      IF(IPIC(1).LT.J3E) GO TO 6                                        NASA    4882
      IF(IPIC(2).LT.J4E) GO TO 7                                        NASA    4883
      IF(IPIC(3).LT.J5E) GO TO 8                                        NASA    4884
      IF(IPIC(4).LT.J6E) GO TO 9                                        NASA    4885
C                                                                       NASA    4886
C     NO ACCEPTABLE COMBINATIONS                                        NASA    4887
C                                                                       NASA    4888
```

```
      ICHOSE(1)= -1
      RETURN
C
    4 CONTINUE
C
      J3= IDB(1) + 1
      J4= IDB(2) + 1
      J5= IDB(3) + 1
      J6= IDB(4) + 1
C
      GO TO 1200
C
    5 CONTINUE
      J3= IPIC(1)
      J4= IPIC(2)
      J5= IPIC(3)
      J6= IPIC(4)
      GO TO 1200
C
    6 CONTINUE
      J3= IPIC(1) + 1
      J4= IPIC(2)
      J5= IPIC(3)
      J6= IPIC(4)
      GO TO 1200
C
    7 CONTINUE
      J3= IDB(1) + 1
      J4= IPIC(2) + 1
      J5= IPIC(3)
      J6= IPIC(4)
      GO TO 1200
C
    8 CONTINUE
      J3= IDB(1) + 1
      J4= IDB(2) + 1
      J5= IPIC(3) + 1
      J6= IPIC(4)
      GO TO 1200
C
    9 CONTINUE
      J3= IDB(1) + 1
      J4= IDB(2) + 1
      J5= IDB(3) + 1
      J6= IPIC(4) + 1
C
 1200 CONTINUE
C
C     THE HARDWARE INDICES ARE SET
C
   32 IF(DATAB(7,J3).LT.CDAISO.OR.DATAB(7,J4).GT.RMAX) GO TO 33
C
C     ISOLATION VALVE AND FILTER ARE ACCEPTABLE
C
      DELPIS = (1.29E-3/RHO)*(WDOTPR/DATAB(7,J3))**2
      DELPFI = DATAB(7,J4)*WDOTPR**2
      ICHOSE(3)= DATAB(1,J3)
```

```
      ICHOSE(4)= DATAB(1,J4)                                            NASA      4946
C                                                                       NASA      4947
C     PRELIMINARY CALCULATIONS FOR SELECTION OF REGULATOR AND TANK      NASA      4948
C                                                                       NASA      4949
      PREG= PTI + 2.*DELPIS + DELPFI                                    NASA      4950
      CDAREG= WDOTPR/SQRT(5600.*PREG/1.27E4)                            NASA      4951
      WPR= 1.1*TOTIMP/65.                                               NASA      4952
      ACSWP= WPR                                                        NASA      4953
      VPRT= 3.4E3*WPR/28.                                               NASA      4954
      IF(PREG.LT.DATAB(8,J5).OR.PREG.GT.DATAB(9,J5).OR.DATAB(7,J5).LT.  NASA      4955
     * CDAREG.OR.DATAB(6,J6).LT.VPRT) GO TO 33                          NASA      4956
C                                                                       NASA      4957
C     REGULATOR AND TANK ARE ACCEPTABLE                                 NASA      4958
      ICHOSE(5)= DATAB(1,J5)                                            NASA      4959
      ICHOSE(6)= DATAB(1,J6)                                            NASA      4960
      TNKWT= DATAB(23,J6)                                               NASA      4961
C                                                                       NASA      4962
C     SIZE PLUMBING AND CONNECTORS                                      NASA      4963
C                                                                       NASA      4964
      PCWATE=.2*DATAB(23,J6)*NCHOSE(6)                                  120574       1
C                                                                       NASA      4966
C     STORE LAST INDICES ACCEPTABLE                                     NASA      4967
C                                                                       NASA      4968
      IPIC(1)= J3                                                       NASA      4969
      IPIC(2)= J4                                                       NASA      4970
      IPIC(3)= J5                                                       NASA      4971
      IPIC(4)= J6                                                       NASA      4972
      N(7)= II                                                          NASA      4973
      N(8)= JJ                                                          NASA      4974
      N(1)= J1                                                          NASA      4975
      N(2)= J2                                                          NASA      4976
      N(3)= J3                                                          NASA      4977
      N(4)= J4                                                          NASA      4978
      N(5)= J5                                                          NASA      4979
      N(6)= J6                                                          NASA      4980
      DO 322 I=1,8                                                      NASA      4981
      J= N(I)                                                           NASA      4982
      WT= WT + NCHOSE(I)*DATAB(23,J)                                    NASA      4983
      VOL= VOL + NCHOSE(I)*DATAB(24,J)                                  NASA      4984
      PL= PL + NCHOSE(I)*DATAB(16,J)                                    NASA      4985
      PLMIN= PLMIN + NCHOSE(I)*DATAB(18,J)                              NASA      4986
  322 CONTINUE                                                          NASA      4987
      ORIWT=WT+PCWATE-WEIGHT(1)                                         111874      59
      WT= WT + ACSWP + PCWATE                                           NASA      4988
      RETURN                                                            NASA      4989
C                                                                       NASA      4990
   33 CONTINUE                                                          NASA      4991
C                                                                       NASA      4992
C     HARDWARE SELECTION NOT ACCEPTABLE - INCREMENT HARDWARE INDICES    NASA      4993
C                                                                       NASA      4994
      IF(J3.LT.J3E) GO TO 34                                            NASA      4995
      IF(J4.LT.J4E) GO TO 35                                            NASA      4996
      IF(J5.LT.J5E) GO TO 36                                            NASA      4997
      IF(J6.LT.J6E) GO TO 37                                            NASA      4998
C                                                                       NASA      4999
C     NO ACCEPTABLE HARDWARE COMBINATION                                NASA      5000
C                                                                       NASA      5001
```

```
      ICHOSE(1)= -1                                                     NASA      5002
      RETURN                                                            NASA      5003
C                                                                       NASA      5004
   34 J3= J3 + 1                                                        NASA      5005
      GO TO 32                                                          NASA      5006
   35 J3= IDB(1) + 1                                                    NASA      5007
      J4= J4 + 1                                                        NASA      5008
      GO TO 32                                                          NASA      5009
   36 J3= IDB(1) + 1                                                    NASA      5010
      J4= IDB(2) + 1                                                    NASA      5011
      J5= J5 + 1                                                        NASA      5012
      GO TO 32                                                          NASA      5013
   37 J3= IDB(1) + 1                                                    NASA      5014
      J4= IDB(2) + 1                                                    NASA      5015
      J5= IDB(3) + 1                                                    NASA      5016
      J6= J6 + 1                                                        NASA      5017
      GO TO 32                                                          NASA      5018
   38 CONTINUE                                                          NASA      5019
      IF(NCONF(2).EQ.3) GO TO 62                                        NASA      5020
C                                                                       NASA      5021
C                                                                       NASA      5022
C     THIS IS MONOPROPELLANT CONFIGURATION                              NASA      5023
C                                                                       NASA      5024
C     DETERMINE MAXIMUM THRUST FROM SANDC                               NASA      5025
C                                                                       NASA      5026
      FMAX= AMAX1(ACTHST,TTHST)                                         NASA      5027
      IF(FMAX.LT.1000..AND.TOTIMP.LT.200000..AND.TOTIMP.GE.10000.) GO   NASA      5028
     * TO 39                                                            NASA      5029
C                                                                       NASA      5030
C     THIS IS NOT AN ACCEPTABLE CONFIGURATION                           NASA      5031
C                                                                       NASA      5032
      ICHOSE(1)= -1                                                     NASA      5033
      RETURN                                                            NASA      5034
C                                                                       NASA      5035
   39 CONTINUE                                                          NASA      5036
      IF(ITER.NE.0) GO TO 42                                            NASA      5038
C                                                                       NASA      5039
C     INITIALIZE ICHOSE,NCHOSE,IERR AND SELECT HARDWARE NOT SIZED       NASA      5040
C      I.E., THE RELIEF VALVE,FILL AND VENT VALVE AND FILL AND DRAIN    NASA      5041
C      VALVE                                                            NASA      5042
C                                                                       NASA      5043
      DO 40 I= 1,14                                                     NASA      5044
      ICHOSE(I)= 0                                                      NASA      5045
   40 NCHOSE(I)= 0                                                      NASA      5046
      IERR= 0                                                           NASA      5047
      NCHOSE(1)=6                                                       NASA      5048
      NCHOSE(2)=2                                                       NASA      5049
      NCHOSE(3)=4                                                       NASA      5050
      NCHOSE(4)=9                                                       NASA      5051
      DO 41 I=5,11                                                      NASA      5052
   41 NCHOSE(I)=1                                                       NASA      5053
C                                                                       NASA      5054
      II= IDB(5) + 1                                                    NASA      5055
      JJ= IDB(6) + 1                                                    NASA      5056
      KK= IDB(11) + 1                                                   NASA      5057
      ICHOSE(9) = DATAB(1,JJ)                                           NASA      5058
      ICHOSE(10)= DATAB(1,KK)                                           NASA      5059
```

```
      ICHOSE(11)= DATAB(1,II)                                           NASA    5060
C                                                                       NASA    5061
   42 CONTINUE                                                          NASA    5062
C                                                                       NASA    5063
C     THRUSTER SELECTION                                                NASA    5064
C                                                                       NASA    5065
C     FIRST CHECK TO SEE IF THERE IS AN ACCEPTABLE THRUSTER IN THE DATA NASA    5066
C     BASE                                                              NASA    5067
C                                                                       NASA    5068
      J1E= IDB(8)                                                       NASA    5069
      J1 = IDB(7) + 1                                                   NASA    5070
  100 THRUST= DATAB(6,J1)                                               NASA    5071
      IF(THRUST.GE.FMAX) GO TO 120                                      NASA    5072
      IF(J1.EQ.J1E) GO TO 110                                           NASA    5073
      J1= J1 + 1                                                        NASA    5074
      GO TO 100                                                         NASA    5075
C                                                                       NASA    5076
C     NO ACCEPTABLE THRUSTERS                                           NASA    5077
C                                                                       NASA    5078
  110 ICHOSE(1)= -1                                                     NASA    5079
      RETURN                                                            NASA    5080
C                                                                       NASA    5081
C     AT LEAST ONE ACCEPTABLE THRUSTER                                  NASA    5082
C                                                                       NASA    5083
  120 CONTINUE                                                          NASA    5084
C                                                                       NASA    5085
C     SELECT PNEUMATIC ATTITUDE AND CONTROL THRUSTERS                   NASA    5086
C                                                                       NASA    5087
C     FIRST DETERMINE SET OF ALL THRUSTERS WHICH SATISFY THE INEQUALITY NASA    5088
C     THRUST GE ACTHST                                                  NASA    5089
C                                                                       NASA    5090
      I= 1                                                              NASA    5091
      J1 = IDB(7) + 1                                                   NASA    5092
  130 THRUST= DATAB(6,J1)                                               NASA    5093
      IF(THRUST.GE.ACTHST) GO TO 150                                    NASA    5094
  140 IF(J1.EQ.J1E) GO TO 160                                           NASA    5095
      J1= J1 + 1                                                        NASA    5096
      GO TO 130                                                         NASA    5097
  150 IACCPT(I)= J1                                                     NASA    5098
      I= I + 1                                                          NASA    5099
      GO TO 140                                                         NASA    5100
  160 CONTINUE                                                          NASA    5101
      IMAX= I - 1                                                       NASA    5102
C                                                                       NASA    5103
C     CHOOSE THAT THRUSTER FROM THE ABOVE SET WHICH MINIMIZES THE       NASA    5104
C     QUANTITY, ABS(THRUST - ACTHST)                                    NASA    5105
C                                                                       NASA    5106
      I=1                                                               NASA    5107
      J1= IACCPT(I)                                                     NASA    5108
      THRUST= DATAB(6,J1)                                               NASA    5109
      DIFOLD= ABS(THRUST - ACTHST)                                      NASA    5110
  170 ICHOSE(1)= DATAB(1,J1)                                            NASA    5111
      JSAVE=J1                                                          NASA    5112
      IF(I.EQ.IMAX) GO TO 200                                           NASA    5113
  180 I= I + 1                                                          NASA    5114
      J1= IACCPT(I)                                                     NASA    5115
      THRUST= DATAB(6,J1)                                               NASA    5116
```

```
      DIFNEW= ABS(THRUST - ACTHST)                                      NASA      5117
      IF(DIFNEW.LE.DIFOLD) GO TO 190                                    NASA      5118
      IF(I.LT.IMAX) GO TO 180                                           NASA      5119
      GO TO 200                                                         NASA      5120
  190 DIFOLD= DIFNEW                                                    NASA      5121
      GO TO 170                                                         NASA      5122
  200 J1=JSAVE                                                          NASA      5123
      T(1)=DATAB(6,J1)                                                  101674       3
C                                                                       NASA      5125
C     SELECT PNEUMATIC TRANSLATIONAL THRUSTERS USING ABOVE PROCEDURE    NASA      5126
C                                                                       NASA      5127
      I= 1                                                              NASA      5128
      J2 = IDB(7) + 1                                                   NASA      5129
  210 THRUST= DATAB(6,J2)                                               NASA      5130
      IF(THRUST.GE.TTHST) GO TO 230                                     NASA      5131
  220 IF(J2.EQ.J1E) GO TO 240                                           NASA      5132
      J2= J2 + 1                                                        NASA      5133
      GO TO 210                                                         NASA      5134
  230 IACCPT(I)= J2                                                     NASA      5135
      I= I + 1                                                          NASA      5136
      GO TO 220                                                         NASA      5137
  240 CONTINUE                                                          NASA      5138
      IMAX= I - 1                                                       NASA      5139
      I= 1                                                              NASA      5140
      J2= IACCPT(I)                                                     NASA      5141
      THRUST= DATAB(6,J2)                                               NASA      5142
      DIFOLD= ABS(THRUST - TTHST)                                       NASA      5143
  250 ICHOSE(2)= DATAB(1,J2)                                            NASA      5144
      JSAVE=J2                                                          NASA      5145
      IF(I.EQ.IMAX) GO TO 280                                           NASA      5146
  260 I= I + 1                                                          NASA      5147
      J2= IACCPT(I)                                                     NASA      5148
      THRUST= DATAB(6,J2)                                               NASA      5149
      DIFNEW= ABS(THRUST - TTHST)                                       NASA      5150
      IF(DIFNEW.LE.DIFOLD) GO TO 270                                    NASA      5151
      IF(I.LT.IMAX) GO TO 260                                           NASA      5152
      GO TO 280                                                         NASA      5153
  270 DIFOLD= DIFNEW                                                    NASA      5154
      GO TO 250                                                         NASA      5155
  280 J2=JSAVE                                                          NASA      5156
      T(2)=DATAB(6,J2)                                                  101674       4
C                                                                       NASA      5158
C     THRUSTERS HAVE BEEN SELECTED                                      NASA      5159
C                                                                       NASA      5160
C     SET NUMBER OF EACH TYPE OF THRUSTER                               NASA      5161
C                                                                       NASA      5162
C                                                                       NASA      5163
C                                                                       NASA      5164
C     CHECK TO SEE IF CYCLE LIFE REQUIREMENT IS SATISFIED               NASA      5165
C                                                                       NASA      5166
      IERR= 0                                                           NASA      5167
      IF(DATAB(7,J1).LT.CLIFE) IERR= 1                                  NASA      5168
      IF(DATAB(7,J2).LT.CLIFE) IERR= IERR + 10                          NASA      5169
C                                                                       NASA      5170
C     IERR= 1 IMPLIES THAT THE CYCLE LIFE OF THE ATTITUDE AND CONTROL   NASA      5171
C     THRUSTERS IS TOO SHORT. IERR= 10 IMPLIES THAT THE CYCLE LIFE OF   NASA      5172
C     THE TRANSLATIONAL THRUSTERS IS TOO SHORT. IERR= 11 IMPLIES THAT   NASA      5173
```

```
C
C     THE CYCLE LIVES OF BOTH THRUSTERS ARE TOO SHORT
C
C
C     PRELIMINARY CALCULATIONS FOR SELECTION OF MONOPROPELLANT ISOLATION
C     VALVES AND FILTERS
C
      RHOF= .036
      WDOTF=(3.*ACTHST + 2.*TTHST)/200.
      IF (NCONF(1) .EQ. 1) WDOTF=TTHST/200.
      CDAISO= WDOTF/SQRT(50.*RHOF/1.29E-3)
      RMAX = 50./WDOTF**2
C
C
C     SET LAST EQUIPMENT INDICES
C
      J3E= IDB(9)
      J4E= IDB(10)
      J5E= IDB(4)
      J6E= IDB(2)
      J7E= IDB(11)
      J8E= IDB(5)
C
C     DETERMINE HARDWARE INDICES
C
      DO 43 I=1,9
      IF(IPIC(I).NE.0) GO TO 44
   43 CONTINUE
      GO TO 45
   44 IF(ITER.NE.0) GO TO 46
      IF(IPIC(1).LT.J3E) GO TO 47
      IF(IPIC(2).LT.J4E) GO TO 48
      IF(IPIC(3).LT.J5E) GO TO 49
      IF(IPIC(4).LT.J6E) GO TO 50
      IF(IPIC(5).LT.J7E) GO TO 51
      IF(IPIC(6).LT.J8E) GO TO 52
C
C     NO ACCEPTABLE COMBINATIONS
C
      ICHOSE(1)= -1
      RETURN
C
   45 CONTINUE
C
      J3= IDB(8) + 1
      J4= IDB(9) + 1
      J5= IDB(3) + 1
      J6= IDB(1) + 1
      J7= IDB(10) + 1
      J8= IDB(4) + 1
      GO TO 53
C
   46 CONTINUE
      J3= IPIC(1)
      J4= IPIC(2)
      J5= IPIC(3)
      J6= IPIC(4)
      J7= IPIC(5)
```

```
      J8= IPIC(6)
      GO TO 53
C
   47 J3= IPIC(1)  + 1
      J4= IPIC(2)
      J5= IPIC(3)
      J6= IPIC(4)
      J7= IPIC(5)
      J8= IPIC(6)
      GO TO 53
C
   48 J3= IDB(8)  + 1
      J4= IPIC(2)  + 1
      J5= IPIC(3)
      J6= IPIC(4)
      J7= IPIC(5)
      J8= IPIC(6)
      GO TO 53
C
   49 J3= IDB(8)  + 1
      J4= IDB(9)  + 1
      J5= IPIC(3)+ 1
      J6= IPIC(4)
      J7= IPIC(5)
      J8= IPIC(6)
      GO TO 53
C
   50 J3= IDB(8)  + 1
      J4= IDB(9)  + 1
      J5= IDB(3)  + 1
      J6= IPIC(4)  + 1
      J7= IPIC(5)
      J8= IPIC(6)
      GO TO 53
C
   51 J3= IDB(8)  + 1
      J4= IDB(9)  + 1
      J5= IDB(3)  + 1
      J6= IDB(1)  + 1
      J7= IPIC(5)  + 1
      J8= IPIC(6)
      GO TO 53
C
   52 J3= IDB(8)  + 1
      J4= IDB(9)  + 1
      J5= IDB(3)  + 1
      J6= IDB(1)  + 1
      J7= IDB(10)  + 1
      J8= IPIC(6)  + 1
C
   53 CONTINUE
C
C     THE HARDWARE INDICES ARE SET
C
   54 IF(DATAB(7,J3).LT.CDAISO.OR.DATAB(7,J4).GT.RMAX) GO TO 55
C
C     FUEL CIRCUIT ISOLATION VALVES AND FILTERS ARE ACCEPTABLE
```

```
      C                                                                 NASA      5288
            DELPIS= (1.29E-3/RHOF)*(WDOTF/DATAB(7,J3))**2               NASA      5289
            DELPFI= DATAB(7,J4)*WDOTF**2                                NASA      5290
            ICHOSE(3)= DATAB(1,J3)                                      NASA      5291
            ICHOSE(4)= DATAB(1,J4)                                      NASA      5292
            IPIC(1)= J3                                                 NASA      5293
            IPIC(2)= J4                                                 NASA      5294
      C                                                                 NASA      5295
      C     PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC REGULATOR NASA      5296
      C                                                                 NASA      5297
            PTI= DATAB(8,J1)                                            NASA      5298
            PFT= PTI + 2.*DELPIS + 2.*DELPFI                            NASA      5299
            PREG= PFT + 2.*DELPIS                                       NASA      5300
            WDOTPR= 28.*1.02E-7*PREG*WDOTF/RHOF                         NASA      5301
            CDAREG= WDOTPR/SQRT(5600.*PREG/1.27E4)                      NASA      5302
      C                                                                 NASA      5303
            IF(PREG.LT.DATAB(8,J5).OR.PREG.GT.DATAB(9,J5).OR.DATAB(7,J5).LT.NASA      5304
           * CDAREG) GO TO 55                                           NASA      5305
      C                                                                 NASA      5306
      C     REGULATOR IS ACCEPTABLE                                     NASA      5307
      C                                                                 NASA      5308
            ICHOSE(5)= DATAB(1,J5)                                      NASA      5309
            IPIC(3)= J5                                                 NASA      5310
      C                                                                 NASA      5311
      C     PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC ISOLATION NASA      5312
      C     VALVE                                                       NASA      5313
      C                                                                 NASA      5314
            RHOPR= 3000.*1.02E-7                                        NASA      5315
            CDAISO= WDOTPR/SQRT(200.*RHOPR/1.29E-3)                     NASA      5316
            IF(DATAB(7,J6).LT.CDAISO) GO TO 55                          NASA      5317
      C                                                                 NASA      5318
      C     PNEUMATIC ISOLATION VALVE IS ACCEPTABLE                     NASA      5319
      C                                                                 NASA      5320
            ICHOSE(6)= DATAB(1,J6)                                      NASA      5321
            IPIC(4)= J6                                                 NASA      5322
      C                                                                 NASA      5323
      C     PRELIMINARY CALCULATIONS FOR SELECTION OF FUEL TANK AND PNEUMATIC NASA    5324
      C     TANK                                                        NASA      5325
      C                                                                 NASA      5326
            WF= 1.1*TOTIMP/200.                                         NASA      5327
            VF= WF/.036                                                 NASA      5328
            VFT= 1.1*VF                                                 NASA      5329
            VPRT= PFT*VFT/(3000. - 2.*PFT)                              NASA      5330
            WPRT=.0085*VPRT                                             NASA      5331
            ACSWP=WF+WPRT                                               NASA      5332
      C                                                                 013075       1
      C     SELECT FUEL TANK.                                           013075       2
      C                                                                 013075       3
            IF (DATAB(7,J7) .LT. PFT) GO TO 55                          013075       4
      C                                                                 013075       5
            IF (MICRO .EQ. 2) GO TO 5005                                022075      15
            IF (DATAB(7,J7).GE.PFT .AND. DATAB(6,J7).GE.VFT) GO TO 5001 013075       6
      C                                                                 013075       7
      C     AT LEAST ONE FUEL TANK IN DATA BASE WHICH SATISFIES PRESSURE  013075     8
      C     DESIGN CRITERIA.                                            013075       9
      C                                                                 013075      10
            J7SAVE = J7                                                 013075      11
```

```
      VFTMAX = DATAB(6,J7)                                              013075    12
C                                                                       013075    13
C     CHECK TO SEE IF THERE IS AT LEAST ONE TANK IN DATA BASE WHICH     013075    14
C     SATISFIES BOTH PRESSURE AND VOLUME DESIGN CRITERIA.               013075    15
C                                                                       013075    16
      JJ7 = IDB(10) + 1                                                 013075    17
 5000 IF (DATAB(6,JJ7).GE.VFT .AND. DATAB(7,JJ7).GE.PFT) GO TO 55       013075    18
      IF (JJ7 .EQ. J7E) GO TO 5002                                      013075    19
      JJ7 = JJ7 + 1                                                     013075    20
      GO TO 5000                                                        013075    21
C                                                                       013075    22
 5002 CONTINUE                                                          013075    23
C                                                                       013075    24
C     NO TANK IN DATA BASE WHICH SATISFIES BOTH THE PRESSURE AND VOLUME 013075    25
C     DESIGN CRITERIA. SELECT TANK WITH LARGEST VOLUME WHICH SATISFIES  013075    26
C     PRESSURE DESIGN CRITERIA.                                         013075    27
C                                                                       013075    28
      JJ7 = IDB(10) + 1                                                 013075    29
C                                                                       013075    30
 5003 IF (DATAB(7,JJ7).LT.PFT .OR. DATAB(6,JJ7).LT.VFTMAX) GO TO 5004   013075    31
      VFTMAX = DATAB(6,JJ7)                                             013075    32
      J7SAVE = JJ7                                                      013075    33
C                                                                       013075    34
C                                                                       013075    35
 5004 JJ7 = JJ7 + 1                                                     013075    36
      IF (JJ7 .LT. J7E + 1) GO TO 5003                                  013075    37
      J7 = J7SAVE                                                       013075    38
 5005 NCHOSE(7) = VFT / DATAB(6,J7) + .5                                022075    16
      IF (NCHOSE(7) .LT. 1) NCHOSE(7) = 1                               022175     1
C                                                                       013075    40
 5001 CONTINUE                                                          013075    41
C                                                                       013075    42
C                                                                       013075    43
      ICHOSE(7) = DATAB(1,J7)                                           013075    44
      IPIC(5) = J7                                                      013075    45
      TNKWT = DATAB(23,J7)                                              013075    46
C                                                                       013075    47
C     SELECT PNEUMATIC TANK                                             013075    48
C                                                                       013075    49
      IF (DATAB(6,J8) .LT. VPRT) GO TO 55                               013075    50
      ICHOSE(8) = DATAB(1,J8)                                           013075    51
      IPIC(6) = J8                                                      013075    52
C                                                                       013075    53
C     SIZE PLUMBING AND CONNECTORS                                      013075    54
C                                                                       013075    55
      PCWATE = .2*(DATAB(23,J7)*NCHOSE(7) + DATAB(23,J8)*NCHOSE(8))     013075    56
      N(9)= JJ                                                          NASA    5358
      N(10)= KK                                                         NASA    5359
      N(11)= II                                                         NASA    5360
      N(1)= J1                                                          NASA    5361
      N(2)= J2                                                          NASA    5362
      N(3)= J3                                                          NASA    5363
      N(4)= J4                                                          NASA    5364
      N(5)= J5                                                          NASA    5365
      N(6)= J6                                                          NASA    5366
      N(7)= J7                                                          NASA    5367
      N(8)= J8                                                          NASA    5368
```

```
      CO 542 I=1,11                                                    NASA      5369
      J= N(I)                                                          NASA      5370
      WT= WT + NCHOSE(I)*DATAB(23,J)                                   NASA      5371
      VOL= VOL + NCHOSE(I)*DATAB(24,J)                                 NASA      5372
      PL= PL + NCHOSE(I)*DATAB(16,J)                                   NASA      5373
      PLMIN= PLMIN + NCHOSE(I)*DATAB(18,J)                             NASA      5374
  542 CONTINUE                                                         NASA      5375
      DRIWT=WT+PCWATE-WEIGHT(1)                                        111874      60
      WT= WT + ACSWP + PCWATE                                          NASA      5376
      RETURN                                                           NASA      5377
C                                                                      NASA      5378
   55 CONTINUE                                                         NASA      5379
C                                                                      NASA      5380
C     HARDWARE SELECTION NOT ACCEPTABLE - INCREMENT HARDWARE INDICES   NASA      5381
C                                                                      NASA      5382
      IF(J3.LT.J3E) GO TO 56                                           NASA      5383
      IF(J4.LT.J4E) GO TO 57                                           NASA      5384
      IF(J5.LT.J5E) GO TO 58                                           NASA      5385
      IF(J6.LT.J6E) GO TO 59                                           NASA      5386
      IF(J7.LT.J7E) GO TO 60                                           NASA      5387
      IF(J8.LT.J8E) GO TO 61                                           NASA      5388
C                                                                      NASA      5389
C     NO ACCEPTABLE HARDWARE                                           NASA      5390
C                                                                      NASA      5391
      ICHOSE(1)= -1                                                    NASA      5392
      RETURN                                                           NASA      5393
C                                                                      NASA      5394
   56 J3= J3 + 1                                                       NASA      5395
      GO TO 54                                                         NASA      5396
   57 J3= IDB(8) + 1                                                   NASA      5397
      J4= J4 + 1                                                       NASA      5398
      GO TO 54                                                         NASA      5399
   58 J3= IDB(8) + 1                                                   NASA      5400
      J4= IDB(9) + 1                                                   NASA      5401
      J5= J5 + 1                                                       NASA      5402
      GO TO 54                                                         NASA      5403
   59 J3= IDB(8) + 1                                                   NASA      5404
      J4= IDB(9) + 1                                                   NASA      5405
      J5= IDB(3) + 1                                                   NASA      5406
      J6= J6 + 1                                                       NASA      5407
      GO TO 54                                                         NASA      5408
   60 J3= IDB(8) + 1                                                   NASA      5409
      J4= IDB(9) + 1                                                   NASA      5410
      J5= IDB(3) + 1                                                   NASA      5411
      J6= IDB(1) + 1                                                   NASA      5412
      J7= J7 + 1                                                       NASA      5413
      GO TO 54                                                         NASA      5414
   61 J3= IDB(8) + 1                                                   NASA      5415
      J4= IDB(9) + 1                                                   NASA      5416
      J5= IDB(3) + 1                                                   NASA      5417
      J6= IDB(1) + 1                                                   NASA      5418
      J7= IDB(10) + 1                                                  NASA      5419
      J8= J8 + 1                                                       NASA      5421
      GO TO 54                                                         NASA      5422
C                                                                      NASA      5423
   62 CONTINUE                                                         NASA      5424
C                                                                      NASA      5425
```

```
C         THIS IS BIPROPELLANT CONFIGURATION
C
          IF(TOTIMP.GE.50000.) GO TO 63
C
C         THIS IS NOT AN ACCEPTABLE CONFIGURATION
C
          ICHOSE(1)= -1
          RETURN
C
   63     CONTINUE
C
C
          IF(ITER.NE.0) GO TO 65
C
C         INITIALIZE ICHOSE,NCHOSE,IERR AND SELECT HARDWARE NOT SIZED
C          I.E., FILL AND DRAIN VALVES,FILL AND VENT VALVE AND RELIEF
C          VALVE
C
          DO 64 I=1,14
          ICHOSE(I)= 0
   64     NCHOSE(I)= 0
          IERR= 0
          NCHOSE(1)=6
          NCHOSE(2)=2
          NCHOSE(3)=3
          NCHOSE(4)=3
          NCHOSE(5)=4
          NCHOSE(6)=4
          DO 649 I=7,11
  649     NCHOSE(I)=1
          NCHOSE(12)=2
          NCHOSE(13)=1
          NCHOSE(14)=1
          II= IDB(5) + 1
          JJ= IDB(6) + 1
          KK= IDB(16) + 1
          ICHOSE(12)= DATAB(1,KK)
          ICHOSE(13)= DATAB(1,II)
          ICHOSE(14)= DATAB(1,JJ)
C
   65     CONTINUE
C
C         THRUSTER SELECTION
C
C         FIRST CHECK TO SEE IF THERE IS AN ACCEPTABLE THRUSTER IN THE DATA
C         BASE
C
          FMAX=AMAX1(ACTHST,TTHST)
          J1E= IDB(13)
          J1 = IDB(12) + 1
  101     THRUST= DATAB(6,J1)
          IF(THRUST.GE.FMAX) GO TO 121
          IF(J1.EQ.J1E) GO TO 111
          J1= J1 + 1
          GO TO 101
C
C         NO ACCEPTABLE THRUSTERS
```

```
C                                                                       NASA    5483
  111 ICHOSE(1)= -1                                                     NASA    5484
      RETURN                                                            NASA    5485
C                                                                       NASA    5486
C     AT LEAST ONE ACCEPTABLE THRUSTER                                  NASA    5487
C                                                                       NASA    5488
  121 CONTINUE                                                          NASA    5489
C                                                                       NASA    5490
C     SELECT PNEUMATIC ATTITUDE AND CONTROL THRUSTERS                   NASA    5491
C                                                                       NASA    5492
C     FIRST DETERMINE SET OF ALL THRUSTERS WHICH SATISFY THE INEQUALITY NASA    5493
C     THRUST GE ACTHST                                                  NASA    5494
C                                                                       NASA    5495
      I= 1                                                              NASA    5496
      J1 = IDB(12) + 1                                                  NASA    5497
  131 THRUST= DATAB(6,J1)                                               NASA    5498
      IF(THRUST.GE.ACTHST) GO TO 151                                    NASA    5499
  141 IF(J1.EQ.J1E) GO TO 161                                           NASA    5500
      J1= J1 + 1                                                        NASA    5501
      GO TO 131                                                         NASA    5502
  151 IACCPT(I)= J1                                                     NASA    5503
      I= I + 1                                                          NASA    5504
      GO TO 141                                                         NASA    5505
  161 CONTINUE                                                          NASA    5506
      IMAX= I - 1                                                       NASA    5507
C                                                                       NASA    5508
C     CHOOSE THAT THRUSTER FROM THE ABOVE SET WHICH MINIMIZES THE       NASA    5509
C     QUANTITY, ABS(THRUST - ACTHST)                                    NASA    5510
C                                                                       NASA    5511
      I=1                                                               NASA    5512
      J1= IACCPT(I)                                                     NASA    5513
      THRUST= DATAB(6,J1)                                               NASA    5514
      DIFOLD= ABS(THRUST - ACTHST)                                      NASA    5515
  171 ICHOSE(1)= DATAB(1,J1)                                            NASA    5516
      JSAVE=J1                                                          NASA    5517
      IF(I.EQ.IMAX) GO TO 201                                           NASA    5518
  181 I= I + 1                                                          NASA    5519
      J1= IACCPT(I)                                                     NASA    5520
      THRUST= DATAB(6,J1)                                               NASA    5521
      DIFNEW= ABS(THRUST - ACTHST)                                      NASA    5522
      IF(DIFNEW.LE.DIFOLD) GO TO 191                                    NASA    5523
      IF(I.LT.IMAX) GO TO 181                                           NASA    5524
      GO TO 201                                                         NASA    5525
  191 DIFOLD= DIFNEW                                                    NASA    5526
      GO TO 171                                                         NASA    5527
  201 J1=JSAVE                                                          NASA    5528
      T(1)=DATAB(6,J1)                                                  101674     5
C                                                                       NASA    5530
C     SELECT PNEUMATIC TRANSLATIONAL THRUSTERS USING ABOVE PROCEDURE    NASA    5531
C                                                                       NASA    5532
      I= 1                                                              NASA    5533
      J2 = IDB(12) + 1                                                  NASA    5534
  211 THRUST= DATAB(6,J2)                                               NASA    5535
      IF(THRUST.GE.TTHST) GO TO 231                                     NASA    5536
  221 IF(J2.EQ.J1E) GO TO 241                                           NASA    5537
      J2= J2 + 1                                                        NASA    5538
      GO TO 211                                                         NASA    5539
```

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  231 IACCPT(I)= J2                                                 NASA    5540
      I= I + 1                                                      NASA    5541
      GO TO 221                                                     NASA    5542
  241 CONTINUE                                                      NASA    5543
      IMAX= I - 1                                                   NASA    5544
      I= 1                                                          NASA    5545
      J2= IACCPT(I)                                                 NASA    5546
      THRUST= DATAB(6,J2)                                           NASA    5547
      DIFOLD= ABS(THRUST - TTHST)                                   NASA    5548
  251 ICHOSE(2)= DATAB(1,J2)                                        NASA    5549
      JSAVE=J2                                                      NASA    5550
      IF(I.EQ.IMAX) GO TO 281                                       NASA    5551
  261 I= I + 1                                                      NASA    5552
      J2= IACCPT(I)                                                 NASA    5553
      THRUST= DATAB(6,J2)                                           NASA    5554
      DIFNEW= ABS(THRUST - TTHST)                                   NASA    5555
      IF(DIFNEW.LE.DIFOLD) GO TO 271                                NASA    5556
      IF(I.LT.IMAX) GO TO 261                                       NASA    5557
      GO TO 281                                                     NASA    5558
  271 DIFOLD= DIFNEW                                                NASA    5559
      GO TO 251                                                     NASA    5560
  281 J2=JSAVE                                                      NASA    5561
      T(2)=DATAB(6,J2)                                              101674     6
C                                                                   NASA    5563
C     THRUSTERS HAVE BEEN SELECTED                                  NASA    5564
C                                                                   NASA    5565
C     SET NUMBER OF EACH TYPE OF THRUSTER                           NASA    5566
C                                                                   NASA    5567
C                                                                   NASA    5568
C                                                                   NASA    5569
C     CHECK TO SEE IF CYCLE LIFE REQUIREMENT IS SATISFIED           NASA    5570
C                                                                   NASA    5571
      IERR= 0                                                       NASA    5572
      IF(DATAB(7,J1).LT.CLIFE) IERR= 1                              NASA    5573
      IF(DATAB(7,J2).LT.CLIFE) IERR= IERR + 10                      NASA    5574
C                                                                   NASA    5575
C     IERR= 1 IMPLIES THAT THE CYCLE LIFE OF THE ATTITUDE AND CONTROL NASA  5576
C     THRUSTERS IS TOO SHORT. IERR= 10 IMPLIES THAT THE CYCLE LIFE OF NASA  5577
C     THE TRANSLATIONAL THRUSTERS IS TOO SHORT. IERR= 11 IMPLIES THAT NASA  5578
C     THE CYCLE LIVES OF BOTH THRUSTERS ARE TOO SHORT               NASA    5579
C                                                                   NASA    5580
C     PRELIMINARY CALCULATIONS FOR SELECTION OF BIPROPELLANT ISOLATION NASA 5581
C     VALVES AND FILTERS                                            NASA    5582
C                                                                   NASA    5583
      RHOF= .032                                                    NASA    5584
      RHOO= .054                                                    NASA    5585
      WDOTF=(3.*ACTHST + 2.*TTHST)/(260.*(1.+XMR))                  NASA    5586
      WDOTO= WDOTF*XMR                                              NASA    5587
      CDAISF= WDOTF/SQRT(50.*RHOF/1.29E-3)                          NASA    5588
      CDAISO= WDOTO/SQRT(50.*RHOO/1.29E-3)                          NASA    5589
      RMAXF= 50./WDOTF**2                                           NASA    5590
      RMAXO= 50./WDOTO**2                                           NASA    5591
C                                                                   NASA    5592
C     SET LAST EQUIPMENT INDICES                                    NASA    5593
C                                                                   NASA    5594
      J3E= IDB(14)                                                  NASA    5595
      J4E= IDB(14)                                                  NASA    5596
```

```
      J5E= IDB(15)
      J6E= IDB(15)
      J7E= IDB(4)
      J8E= IDB(2)
      J9E= IDB(16)
      J10E= IDB(16)
      J11E= IDB(5)
C
C     DETERMINE HARDWARE INDICES
C
      DO 66 I=1,9
      IF(IPIC(I).NE.0) GO TO 67
   66 CONTINUE
      GO TO 68
   67 IF(ITER.NE.0) GO TO 69
      IF(IPIC(1).LT.J3E) GO TO 70
      IF(IPIC(2).LT.J4E) GO TO 71
      IF(IPIC(3).LT.J5E) GO TO 72
      IF(IPIC(4).LT.J6E) GO TO 73
      IF(IPIC(5).LT.J7E) GO TO 74
      IF(IPIC(6).LT.J8E) GO TO 75
      IF(IPIC(7).LT.J9E) GO TO 76
      IF(IPIC(8).LT.J10E) GO TO 77
      IF(IPIC(9).LT.J11E) GO TO 78
C
C     NO ACCEPTABLE COMBINATIONS
C
      ICHOSE(1)= -1
      RETURN
C
   68 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= IDB(1) + 1
      J9= IDB(15) + 1
      J10= IDB(15) + 1
      J11= IDB(4) + 1
      GO TO 79
C
   69 CONTINUE
      J3= IPIC(1)
      J4= IPIC(2)
      J5= IPIC(3)
      J6= IPIC(4)
      J7= IPIC(5)
      J8= IPIC(6)
      J9= IPIC(7)
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   70 J3= IPIC(1) + 1
      J4= IPIC(2)
      J5= IPIC(3)
      J6= IPIC(4)
```

```
      J7= IPIC(5)
      J8= IPIC(6)
      J9= IPIC(7)
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   71 J3= IDB(13) + 1
      J4= IPIC(2) + 1
      J5= IPIC(3)
      J6= IPIC(4)
      J7= IPIC(5)
      J8= IPIC(6)
      J9= IPIC(7)
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   72 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IPIC(3) + 1
      J6= IPIC(4)
      J7= IPIC(5)
      J8= IPIC(6)
      J9= IPIC(7)
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   73 CONTINUE
      J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IPIC(4) + 1
      J7= IPIC(5)
      J8= IPIC(6)
      J9= IPIC(7)
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   74 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IPIC(5) + 1
      J8= IPIC(6)
      J9= IPIC(7)
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   75 CONTINUE
      J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
```

```
      J7= IDB(3) + 1
      J8= IPIC(6) + 1
      J9= IPIC(7)
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   76 CONTINUE
      J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= IDB(1) + 1
      J9= IPIC(7) + 1
      J10= IPIC(8)
      J11= IPIC(9)
      GO TO 79
C
   77 CONTINUE
      J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= IDB(1) + 1
      J9= IDB(15) + 1
      J10= IPIC(8) + 1
      J11= IPIC(9)
      GO TO 79
C
   78 CONTINUE
      J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= IDB(1) + 1
      J9= IDB(15) + 1
      J10= IDB(15) + 1
      J11= IPIC(9) + 1
C
   79 CONTINUE
C
C     THE HARDWARE INDICES ARE SET
C
   80 IF(DATAB(7,J3).LT.CDAISF.OR.DATAB(7,J4).LT.CDAISO.OR.DATAB(7,J5).
     * GT.RMAXF.OR.DATAB(7,J6).GT.RMAXO) GO TO 81
C
C     FUEL CIRCUIT AND OXIDIZER CIRCUIT ISOLATION VALVES AND FILTERS
C     ARE ACCEPTABLE
C
      DLPISF= (1.29E-3/RHOF)*(WDOTF/DATAB(7,J3))**2
      DLPISO= (1.29E-3/RHOO)*(WDOTO/DATAB(7,J4))**2
      DLPFIF= DATAB(7,J5)*WDOTF
      DLPFIO= DATAB(7,J6)*WDOTO
      ICHOSE(3)= DATAB(1,J3)
```

```
      ICHOSE(4)= DATAB(1,J4)
      ICHOSE(5)= DATAB(1,J5)
      ICHOSE(6)= DATAB(1,J6)
      IPIC(1)= J3
      IPIC(2)= J4
      IPIC(3)= J5
      IPIC(4)= J6
C
C     PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC REGULATOR
C
      PTI= DATAB(8,J1)
      PFT= PTI + 2.*DLPISF + 2.*DLPFIF
      POT= PTI + 2.*DLPISO + 2.*DLPFIO
      PREG= AMAX1(PFT,POT)
      WDOTPR= 1.05*1.02E-7*28.*PREG*(WDOTF/RHOF + WDOTO/RHOO)
      CDAREG= WDOTPR/SQRT(5600.*PREG/1.27E4)
C
      IF(PREG.LT.DATAB(8,J7).OR.PREG.GT.DATAB(9,J7).OR.DATAB(7,J7).LT.
     * CDAREG) GO TO 81
C
C     REGULATOR IS ACCEPTABLE
C
      ICHOSE(7)= DATAB(1,J7)
      IPIC(5)= J7
C
C     PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC ISOLATION
C     VALVE
C
      RHOPR= 1.02E-7*3000.
      CDAISO= WDOTPR/SQRT(200.*RHOPR/1.29E-3)
      IF(DATAB(7,J8).LT.CDAISO) GO TO 81
C
C     PNEUMATIC ISOLATION VALVE IS ACCEPTABLE
C
      ICHOSE(8)= DATAB(1,J8)
      IPIC(6)= J8
C
C     PRELIMINARY CALCULATIONS FOR SELECTION OF FUEL TANK,OXIDIZER
C     TANK AND PNEUMATIC TANK
C
      WP= 1.1*TOTIMP/260.
      WF= WP/(1. + XMR)
      VF= WF/RHOF
      VFT= 1.1*VF
      WO= WF*XMR
      ACSWP= WF + WO
      VO= WO/RHOO
      VOT= 1.1*VO
      VPRT= PFT*(VFT + VOT)/(3000. - 2.*PFT)
C
      IF(DATAB(6,J9).LT.VFT.OR.DATAB(7,J9).LT.PFT.OR.DATAB(6,J10).LT.
     * VOT.OR.DATAB(7,J10).LT.POT.OR.DATAB(6,J11).LT.VPRT) GO TO 81
C
C     FUEL TANK, OXIDIZER TANK AND PNEUMATIC TANK ARE ACCEPTABLE
C
      ICHOSE(9)= DATAB(1,J9)
      ICHOSE(10)= DATAB(1,J10)
```

```
      ICHOSE(11)= DATAB(1,J11)                                          NASA      5825
      TNKWT= DATAB(23,J9) + DATAB(23,J10)                               NASA      5826
C                                                                       NASA      5827
C     SIZE PLUMBING AND CONNECTORS                                      NASA      5828
C                                                                       NASA      5829
      PCWATE=.2*(DATAB(23,J9)*NCHOSE(9)+DATAB(23,J10)*NCHOSE(10)        120574       3
     1      +DATAB(23,J11)*NCHOSE(11))                                  120574       4
C                                                                       NASA      5831
      IPIC(7)= J9                                                       NASA      5832
      IPIC(8)= J10                                                      NASA      5833
      IPIC(9)= J11                                                      NASA      5834
      N(12)= KK                                                         NASA      5835
      N(13)= II                                                         NASA      5836
      N(14)= JJ                                                         NASA      5837
      N(1)= J1                                                          NASA      5838
      N(2)= J2                                                          NASA      5839
      N(3)= J3                                                          NASA      5840
      N(4)= J4                                                          NASA      5841
      N(5)= J5                                                          NASA      5842
      N(6)= J6                                                          NASA      5843
      N(7)= J7                                                          NASA      5844
      N(8)= J8                                                          NASA      5845
      N(9)= J9                                                          NASA      5846
      N(10)= J10                                                        NASA      5847
      N(11)= J11                                                        NASA      5848
      DO 802 I=1,14                                                     NASA      5849
      J= N(I)                                                           NASA      5850
      WT= WT + NCHOSE(I)*DATAB(23,J)                                    NASA      5851
      VOL= VOL + NCHOSE(I)*DATAB(24,J)                                  NASA      5852
      PL= PL + NCHOSE(I)*DATAB(16,J)                                    NASA      5853
      PLMIN= PLMIN + NCHOSE(I)*DATAB(18,J)                              NASA      5854
  802 CONTINUE                                                          NASA      5855
      DRIWT=WT+PCWATE-WEIGHT(1)                                         111874      61
      WT= WT + ACSWP + PCWATE                                           NASA      5856
      RETURN                                                            NASA      5857
C                                                                       NASA      5858
   81 CONTINUE                                                          NASA      5859
C                                                                       NASA      5860
C     HARDWARE SELECTION NOT ACCEPTABLE - INCREMENT HARDWARE INDICES    NASA      5861
C                                                                       NASA      5862
      IF(J3.LT.J3E) GO TO 82                                            NASA      5863
      IF(J4.LT.J4E) GO TO 83                                            NASA      5864
      IF(J5.LT.J5E) GO TO 84                                            NASA      5865
      IF(J6.LT.J6E) GO TO 85                                            NASA      5866
      IF(J7.LT.J7E) GO TO 86                                            NASA      5867
      IF(J8.LT.J8E) GO TO 87                                            NASA      5868
      IF(J9.LT.J9E) GO TO 88                                            NASA      5869
      IF(J10.LT.J10E) GO TO 89                                          NASA      5870
      IF(J11.LT.J11E) GO TO 90                                          NASA      5871
C                                                                       NASA      5872
C     NO ACCEPTABLE HARDWARE                                            NASA      5873
C                                                                       NASA      5874
      ICHOSE(1)= -1                                                     NASA      5875
      RETURN                                                            NASA      5876
C                                                                       NASA      5877
   82 J3= J3 + 1                                                        NASA      5878
      GO TO 80                                                          NASA      5879
```

```
   83 J3= IDB(13) + 1
      J4= J4 + 1
      GO TO 80
   84 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= J5 + 1
      GO TO 80
   85 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= J6 + 1
      GO TO 80
   86 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= J7 + 1
      GO TO 80
   87 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= J8 + 1
      GO TO 80
   88 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= IDB(1) + 1
      J9= J9 + 1
      GO TO 80
   89 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= IDB(1) + 1
      J9= IDB(15) + 1
      J10= J10 + 1
      GO TO 80
   90 J3= IDB(13) + 1
      J4= IDB(13) + 1
      J5= IDB(14) + 1
      J6= IDB(14) + 1
      J7= IDB(3) + 1
      J8= IDB(1) + 1
      J9= IDB(15) + 1
      J10= IDB(15) + 1
      J11= J11 + 1
      GO TO 80
C
      END
REGISTER ALLOCATION
4 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 318
```

```
            FUNCTION GAM(X)                                                  NASA      5934
            IF (X.GT.1) GO TO 2                                              NASA      5935
            Z=X                                                              NASA      5936
          1 IF (Z.GT.0.) GO TO 3                                             NASA      5937
            Z=Z+1.                                                           NASA      5938
            GO TO 1                                                          NASA      5939
          2 Z=X-1.                                                           NASA      5940
          3 T1=Z+.5                                                          NASA      5941
            TZG=T1+5.                                                        NASA      5942
            T1=TZG**T1                                                       NASA      5943
            T1=EXP(-TZG)*T1*2.50662827465                                    NASA      5944
            GAMZ=T1*(1.+76.18009173/(Z+1.)-86.50532033/(Z+2.)+24.01409822/   NASA      5945
           G (Z+3.)-1.231739516/(Z+4.)+.120858003E-2/(Z+5.)-.536382E-5/(Z+6.)) NASA    5946
            IF (X.GT.1) GO TO 5                                              NASA      5947
          4 GAMZ=GAMZ/Z                                                      NASA      5948
            IF (Z.EQ.X) GO TO 5                                              NASA      5949
            Z=Z-1.                                                           NASA      5950
            GO TO 4                                                          NASA      5951
          5 GAM=GAMZ                                                         NASA      5952
            RETURN                                                           NASA      5953
            END                                                              NASA      5954
      C     ............................................................... NASA      5955
```

```
      FUNCTION CERF(Y)                                                  NASA  5956
      DIMENSION B(28),A(26),AA(17),BB(19)                               NASA  5957
      IF(Y.GT.4.0)GO TO 2                                               NASA  5958
      DATA AZERO    / 3.88730365/                                       NASA  5959
      DATA A(1)     /-1.38163142/                                       NASA  5960
      DATA A(2)     / .647316404/                                       NASA  5961
      DATA A(3)     /-.305931024/                                       NASA  5962
      DATA A(4)     /.1386797472/                                       NASA  5963
      DATA A(5)     /-.05924745/                                        NASA  5964
      DATA A(6)     /.023691751/                                        NASA  5965
      DATA A(7)     /-.00884736263/                                     NASA  5966
      DATA A(8)     / .00308566171/                                     NASA  5967
      DATA A(9)     /-.001006386351/                                    NASA  5968
      DATA A(10)    /.0003075463288 43/                                 NASA  5969
      DATA A(11)    /-.88261983E-04     /                               NASA  5970
      DATA A(12)    / .23845096E-04     /                               NASA  5971
      DATA A(13)    /-.60791002E-05     /                               NASA  5972
      DATA A(14)    / .1465972 17E-05    /                              NASA  5973
      DATA A(15)    /-.03351 5993E-05    /                              NASA  5974
      DATA A(16)    / .007280579E-05     /                              NASA  5975
      DATA A(17)    /-.001505791E-05     /                              NASA  5976
      DATA A(18)    / .297094742E-08     /                              NASA  5977
      DATA A(19)    /-.560212739E-09     /                              NASA  5978
      DATA A(20)    / .101131623E-09     /                              NASA  5979
      DATA A(21)    /-.17506504E-10            /                        NASA  5980
      DATA A(22)    /.029103813E-10/                                    NASA  5981
      DATA A(23)    /-.4653264E-12           /                          NASA  5982
      DATA A(24)    / .7164815E-13           /                          NASA  5983
      DATA A(25)    /-.1063749E-13           /                          NASA  5984
      DATA A(26)    / .152467E-14           /                           NASA  5985
      DATA B(27)    / .0                          /                     NASA  5986
      DATA B(28)    / .0                          /                     NASA  5987
      DATA AAZERO   / 1.970705272/                                      NASA  5988
      DATA AA(1)    /-.014339740271775/                                 NASA  5989
      DATA AA(2)    / .000297361692 20261/                              NASA  5990
      DATA AA(3)    /-.98035160E-05/                                    NASA  5991
      DATA AA(4)    / .04331334E-05    /                                NASA  5992
      DATA AA(5)    /-.2362150E-07   /                                  NASA  5993
      DATA AA(6)    / .1515496E-08   /                                  NASA  5994
      DATA AA(7)    /-.11084939E-09   /                                 NASA  5995
      DATA AA(8)    / .90425901E-11 /                                   NASA  5996
      DATA AA(9)    /-.80947054E-12/                                    NASA  5997
      DATA AA(10)   / .7853856E-13/                                     NASA  5998
      DATA AA(11)   /-.817918E-14/                                      NASA  5999
      DATA AA(12)   / .90715E-15                  /                     NASA  6000
      DATA AA(13)   /-.10646E-15                  /                     NASA  6001
      DATA AA(14)   / .01315E-15                  /                     NASA  6002
      DATA AA(15)   /-.00170E-15                  /                     NASA  6003
      DATA AA(16)   / .00023E-15                  /                     NASA  6004
      DATA AA(17)   /-.00003E-15                  /                     NASA  6005
      DATA BB(18)   / .0                          /                     NASA  6006
      DATA BB(19)   / .0                          /                     NASA  6007
      X=Y/4.                                                            NASA  6008
      COEFF=4.*X*X-2.                                                   NASA  6009
```

```
           DO 1  I=1,26                                                      NASA      6010
           J=27-I                                                            NASA      6011
         1 B(J)=COEFF*B(J+1)-B(J+2)+A(J)                                     NASA      6012
           BZERO=COEFF*B(1)-B(2)+AZERO                                       NASA      6013
              CERF=X/2.*(BZERO-B(2))                                         NASA      6014
           RETURN                                                            NASA      6015
         2 X=4./Y                                                            NASA      6016
           COEFF=4.*X*X-2.                                                   NASA      6017
           DO 3  I=1,17                                                      NASA      6018
           J=18-I                                                            NASA      6019
         3 BB(J)=COEFF*BB(J+1)-BB(J+2)+AA(J)                                 NASA      6020
           BBZERO=COEFF*BB(1)-BB(2)+AAZERO                                   NASA      6021
              CERF=(BBZERO-BB(2))/(2.*Y*EXP(Y*Y))*.56418958354775€           NASA      6022
           RETURN                                                            NASA      6023
           END                                                               NASA      6024
C          ......................................................................... NASA      6025
```

```
      SUBROUTINE RELY (IRTN,IDS,NEQUIP)                                 NASA      6026
      COMMON /USERR/       ISPT,     ISUB,     KEOPT,    RFIXED,    SLBMX 022575     570
C                                                                       022575     571
      COMMON /USERI/    APOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME, 022575     572
     1                  EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT, 022575     573
     2                  EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY, 022575     574
     3        IDEBUG,   ISATOR,   MB12SH,      TBI,   ORBINC,   PERIGE, 022575     575
     4         MICRO,     RFNL,  SPEC(6),     CONS,        T,   XCGSA1, 022575     576
     5                    XMER,     XMEU                                022575     577
C                                                                       022575     578
      COMMON /BTWN/      ACSSN,    ACSWP,      ALT,     AREA,   BATCAP, 022575     579
     1           BITRAT(2),       CLIFE,   CONVWT,    XDUM2,       DT, 022575     580
     2                      DX,       DY,       DZ,    EQBLG,   EQBSID, 022575     581
     3                      FC,       FF,   HARNWT,      HPT,   HTPIPE, 022575     582
     4                    HTPT,   HTRFRB,   HTRPWR,               IBTLOC, 022575     583
     5                       D,       NC,    OMEGS,   PASSTR,       PJ, 022575     584
     6                      PL,    PLMIN,   POCNWT,     RADA,   RADAB, 022575     585
     7                     RAT,       RJ,   SABOLG,    SATLG,   SATTWT, 022575     586
     8                   SATWT,   SATXCG,   SATYCG,   SATZCG,    SA1XL, 022575     587
     9                   SA1YL,    SA1ZL,     SIDE,   SYSLB,   THCMWT, 022575     588
     A           THRUST(2),          TI,    TNKWT,    TPRIM,       VB, 022575     589
     B                    VCHP,      VOL,     WATE,       WB,      WBT, 022575     590
     C                      WT,       XJ,    NZERO,       YJ,       ZJ 022575     591
C                                                                       022575     592
      COMMON /DBCOM/ R(31),NR(60),RI(31,60),Z(31),RD(31),RDUM(31),      022575     593
     *               SAVR(31),SAVNRW(31),RNEW(31),NMX(60),SAVMX(60),    022575     594
     *               COST(60),DUM(3213)                                 022575     595
C                                                                       022575     596
      COMMON /CHOSE/     COSTM(5,60),      OPIA(11,60),     ICHOSE(60), 022575     597
     1                   NCHOSE(60),     DATAB ( 6,60),    SKD(7,60),   022575     598
     2                   THM(4,60)                                      022575     599
C                                                                       022575     600
      COMMON/PRTCOM/    ACCRCY,       AM,       AN,       BF,       BS, 022575     601
     1           COPI(7,2),      CISTAR,     CTOT,     DDTE,       DE, 022575     602
     2                   DRIWT,   EQBSTR,   FEEINV,   FEEOPS,     FEER, 022575     603
     3                     GSE,     IREL,   ITRUNC,   MMDOLD,NAME(3,60), 022575    604
     4                     OPS,   PAYINV,   PAYQUL,     PAYR,       PE, 022575     605
     5                     PMP,      PMR, POWER(6),       PU,  PWR(60), 022575     606
     6                     QCP,      QCR, ROLD(60),   SABMWT,   SATADP, 022575     607
     7                  SATINV,     SATR,     SEIP,     SEIR, SKTAU(6), 022575     608
     8               SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7),  022575     609
     9                      TA, TAU(6,6),    XDUM1,       TC,       TE, 022575     610
     A                      TF,    TOOLR,    TOOLU,   TOTOPS,    TRUNC, 022575     611
     B                      TS,      TTT,VOLUME(6), VOL(60),WEIGHT(6),  022575     612
     C                   XLTOT,     XMEH,   XMEINV,     XMEL,    XMEVL, 022575     613
     D                    XMEW,   XMEWT,    XVEST                       022575     614
      DIMENSION N(5),NEQUIP(5)                                          NASA      6042
      REAL  MMDOLD,MMDNEW,LAMS,NZERO                                    NASA      6045
      INTEGER  SAVMX,SAVNSR                                             NASA      6046
C     ...............................................................   NASA      6047
C                                                                       NASA      6048
C                                  INITIAL                              NASA      6049
C        VARIABLES        SIZE     ORIGIN-        DEFN                  NASA      6050
C                                  CHANGE                               NASA      6051
```

```
C          NSMX          1        EXT-NC      MAX NUM SYSTEM REDUNDANCIES       NASA    6052
C          NSR           1        EXT- C      CURRENT NUM OF SYSTEM             NASA    6053
C                                             REDUNDANCIES                      NASA    6054
C          IRTN          1        EXT-NC      RETURN INDICATOR                  NASA    6055
C          JMIN          1        EXT-NC      LOWER LIMIT ON MODULE NUM         NASA    6056
C          JMAX          1        EXT-NC      UPPER LIMIT ON MODULE NUM         NASA    6057
C           NR         N(NSS)     EXT- C      CURRENT NUM OF REDUNDANCIES IN    NASA    6058
C                                             MODULE J                          NASA    6059
C          NMX         N(NSS)     EXT-NC      MAX NUM REDUNDANCIES IN MODULE    NASA    6060
C                                             J                                 NASA    6061
C                                             =1          R(TRUNC) MODE         NASA    6062
C          NT            1        EXT-NC      LOOP AND OPTION PARAMETER         NASA    6063
C         DELH           1        EXT-NC      TIME INCREMENT                    NASA    6064
C        ITRUNC          1        EXT-NC      NUM OF  TIME  POINTS              NASA    6065
C           R          ITRUNC      INT        RELIABILITY FNC FOR MODULE J      NASA    6066
C                                             =ITRUNC     MMD MODE              NASA    6067
C         ROLD         ITRUNC     EXT- C      PREVIOUS VALUE OF SYSTEM          NASA    6068
C                                             RELIABILITY                       NASA    6069
C         RNEW         ITRUNC      INT        SYSTEM RELIABILITY WITH WITH A    NASA    6070
C                                             REDUNDANCY ADDED                  NASA    6071
C          RI          ITRUNC     EXT- C      SYSTEM RELIABILITY MATRIX         NASA    6072
C                     *N(NSS)                                                   NASA    6073
C         COST         N(NSS)     EXT-NC      VALUE OF EXPENSE OPTION FOR       NASA    6074
C                                             MODULE J                          NASA    6075
C          RHO           1         INT        DECISION PARAMETER(               NASA    6076
C                                               ABS(*NEW - *OLD)/EXPENSE        NASA    6077
C        RHOTH           1        EXT-NC      LOWER BOUND FOR RHO               NASA    6078
C         OLDRHO         1         INT        PREVIOUS VALUE OF RHO             NASA    6079
C         MMDOLD         1         INT        PREVIOUS MMD VALUE                NASA    6080
C         MMDNEW         1         INT        MMD VALUE WITH A REDUNDANCY       NASA    6081
C                                             ADDED                             NASA    6082
C         JSAVE          1         INT        MODULE WITH LARGEST VALUE OF      NASA    6083
C                                             RHO                               NASA    6084
C        SAVRNW        ITRUNC      INT        SYSTEM RELIABILITY FNC WITH A     NASA    6085
C                                             REDUNDANCY IN MODULE JSAVE        NASA    6086
C         SAVR         ITRUNC      INT        RELIABILITY FNC FOR MODULE        NASA    6087
C                                             JSAVE WITH A REDUNDANCY ADDED     NASA    6088
C        SAVMMD          1         INT        MMD WITH A REDUNDANCY ADDED IN    NASA    6089
C                                             MODULE JSAVE                      NASA    6090
C        SYSLB           1        EXT- C      SYSTEM WEIGHT                     NASA    6091
C        SLBMX           1        EXT-NC      MAX SYSTEM WEIGHT                 NASA    6092
C      DATAB(1,J)      N(NSS)     EXT-NC      REDUNDANCY WEIGHT FOR MODULE J    NASA    6093
C          IND           1         INT        LOOP INDEX                        NASA    6094
C           I            1         INT        INDEX                             NASA    6095
C        RFIXED          1        EXT-NC      INITIAL RELIABILITY               NASA    6096
C                                                                               NASA    6097
C     SUBROUTINES CALLED                                                        NASA    6098
C                               QSF -  INTEGRATION BY SIMPSON*S RULE  (SSP)     NASA    6099
C                               RIMOD- RELIAEILITY MODELS CALCULATION           NASA    6100
C                                                                               NASA    6101
C     ....................................................................      NASA    6102
C            *** PROGRAM INITIALIZATIONS   ***                                  NASA    6103
C                                                                               NASA    6104
C     ....................................................................      NASA    6105
      DO 110 I=1,60                                                             NASA    6106
110   NR(I)=0                                                                   NASA    6107
                                                                                NASA    6108
```

```
C                       ***   USER INPUTS   ***                          NASA  6109
C                                                                        NASA  6110
C         KEOPT         EXPENSE OPTION INDICATOR                         NASA  6111
C                                    1         WEIGHT                    NASA  6112
C                                    OTHERWISE COST                      NASA  6113
C                                                                        NASA  6114
C         RFIXED        INITIAL SYS RELIABILITY                          NASA  6115
C                                                                        NASA  6116
C         SYSLB         INITIAL WEIGHT (POUNDS)                          NASA  6117
C                                                                        NASA  6118
C         SLBMX         MAX SYS WEIGHT                                   NASA  6119
C                                                                        NASA  6120
C         TRUNC         MISSION LENGTH (HRS)                             NASA  6121
C                                                                        NASA  6122
C         ITRUNC        NUM OF TIME POINTS                               NASA  6123
C                                                                        NASA  6124
C         ISUB          REQUIREMENTS OPTION                              NASA  6125
C                                    1         AT LEAST ONE SUB-SYS SPEC NASA  6126
C                                    OTHERWISE NO SUB-SYS SPEC           NASA  6127
C                                                                        NASA  6128
C         ISPT          SINGLE POINT FAILURE REQUIREMENTS OPTION         NASA  6129
C                                    0         REQ NOT IN EFFECT         NASA  6130
C                                    OTHERWISE REQ IN EFFECT             NASA  6131
C                                                                        NASA  6132
C         SPEC1         MMD SYS REQUIREMENT (HRS)                        NASA  6133
C                                                                        NASA  6134
C         SPEC(K)       R(ITRUNC) SUB-SYS REQ; K=1,NSS                   NASA  6135
C                                 DEFAULT VALUE IS 0.0                   NASA  6136
C                                                                        NASA  6137
C         SPEC(NSS+1)   R(ITRUNC) SYS REQ   DEFAULT VALUE IS 0.0         NASA  6138
C                                                                        NASA  6139
C         N(K)          CUMULATIVE NUM OF MODULES THRU SUB-SYS K         NASA  6140
C                                                                        NASA  6141
          TRUNC=TPRIM*730.                                               NASA  6142
          IF (RFNL .LE. 0.999) ALPHA=TRUNC/((-ALOG(RFNL))**.625)         NASA  6143
          SPEC1=CONS*730.                                                NASA  6144
          ITRUNC=31                                                      NASA  6145
          SYSLB=SATTWT                                                   NASA  6146
C                                              SET NUM OF SUB SYS        NASA  6147
          NSS=5                                                          NASA  6148
C                                              ACCUMULATE N              NASA  6149
          N(1)=NEQUIP(1)                                                 NASA  6150
          DO 100 I=2,NSS                                                 NASA  6151
    100   N(I)=NEQUIP(I)+N(I-1)                                          NASA  6152
C                        ***   SIS INPUTS   ***                          NASA  6153
C                                                                        NASA  6154
C         ACSWP         INITIAL EXPENDABLES WEIGHT  (POUNDS)       AP    NASA  6155
C                                                                        NASA  6156
C         EMU           EXPENDABLES INITIAL MEAN LIFETIME  (HRS)   AP    NASA  6157
C                                                                        NASA  6158
C         ESIG          EXPENDABLES INITIAL STD. DEV.  (HRS)       AP    NASA  6159
C                                                                        NASA  6160
C         MAXEXP        MAX NUM OF EXPENDABLE INCREMENTS           AP    NASA  6161
C                                                                        NASA  6162
C         NZERO         ORBITAL MEAN MOTION  (RAD/HRS)             AP    NASA  6163
C                                                                        NASA  6164
C         DC            DUTY CYCLE                                 OTHER NASA  6165
```

```
      C                                                                         NASA      6166
      C     TB            BATTERY TEMP  (DEGREES KELVIN)                  OTHER NASA      6167
      C                                                                         NASA      6168
      C     D             DEPTH OF DISCHARGE  (BETWEEN 0 AND 100)         OTHER NASA      6169
      C                                                                         NASA      6170
      C     NC            TOTAL NUM OF CELLS  (ALL BATTERIES)             OTHER NASA      6171
      C                                                                         NASA      6172
      C     PARAMETERS NECESSARY TO COMPUTE THE CYCLES/HR FACTOR          S^C   NASA      6173
      C                   NOW FIXED AT 4.0E-11, REF MODEL 5                     NASA      6174
      C                                                                         NASA      6175
            EMU=TRUNC                                                           NASA      6176
            ESIG=TRUNC/6.                                                       NASA      6177
            MAXEXP=20                                                           NASA      6178
            DC=.1                                                               NASA      6179
            TB=TBI+273.                                                         NASA      6180
      C                                                                         NASA      6181
      C                                                                         NASA      6182
      C                ***   FIXED CONSTANTS   ***                              NASA      6183
      C                                                                         NASA      6184
      C                                     SENSE/SWITCH FAILURE RATE           NASA      6185
            LAMS=120.                                                           NASA      6186
      C                                     PAYOFF THRESHOLD, R(TRUNC)          NASA      6187
            RHO1=0.00001                                                        NASA      6188
      C                                     PAYOFF THRESHOLD, MMD               NASA      6189
            RHO2=0.1                                                            NASA      6190
      C                                     EXPENDABLES LIFE INCR.              NASA      6191
            DELMU=2190.                                                         NASA      6192
      C                                     EXPENDABLES STD. DEV. INCR.         NASA      6193
            DELSIG=365.                                                         NASA      6194
      C                                                                         NASA      6195
      C     ............................................................       NASA      6196
      C                                                                         NASA      6197
      C               ***   SYS PARAM SPECIFICATION   ***                       NASA      6198
      C                                                                         NASA      6199
      C     ............................................................       NASA      6200
      C                                     R-SHIFT NCHOSE AND COLUMNS OF       NASA      6201
      C                                     DATAB BY 1 BEGINNING WITH THE       NASA      6202
      C                                     THIRD SUB-SYS                       NASA      6203
            JMIN=N(2)+1                                                         NASA      6204
            JMAX=N(NSS)                                                         NASA      6205
      C                                     INITIALIZE                          NASA      6206
            DO 130 I=1,6                                                        NASA      6207
      130   Z(I)=DATAB(I,JMIN)                                                  NASA      6208
            NZ=NCHOSE(JMIN)                                                     NASA      6209
            DO 140 J=JMIN,JMAX                                                  NASA      6210
      C                                     SHIFT NCHOSE                        NASA      6211
            NY=NCHOSE(J+1)                                                      NASA      6212
            NCHOSE(J+1)=NZ                                                      NASA      6213
            NZ=NY                                                               NASA      6214
            DO 140 I=1,6                                                        NASA      6215
      C                                     SHIFT DATAB                         NASA      6216
            R(I)=DATAB(I,J+1)                                                   NASA      6217
             DATAB(I,J+1)=Z(I)                                                  NASA      6218
            Z(I)=R(I)                                                           NASA      6219
      140   CONTINUE                                                            NASA      6220
      C                                     INSERT EXPENDABLES PARAMETERS       NASA      6221
            DATAB(1,JMIN) = 3. *(ACSWP+TNKWT)/TPRIM                             110774       1
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```
      DATAB(2,JMIN)=4.                                              NASA  6223
      DATAB(3,JMIN)=EMU                                             NASA  6224
      DATAB(4,JMIN)=ESIG                                            NASA  6225
      DATAB(5,JMIN)=DELMU                                           NASA  6226
      DATAB(6,JMIN)=DELSIG                                          NASA  6227
C                                   SET MAX NUM OF REDUNDANT ELE.   NASA  6228
      NMX(JMIN)=MAXEXP                                              NASA  6229
      SAVMX(JMIN)=NMX(JMIN)                                         NASA  6230
C                                   RESET N(K)                      NASA  6231
      DO 150 K=2,NSS                                                NASA  6232
150   N(K)=N(K)+1                                                   NASA  6233
      JMAX=JMAX+1                                                   NASA  6234
C                                   SWEEP DATAB AND COMPUTE MODEL   NASA  6235
C                                   PARAMETERS                      NASA  6236
      DO 160 J=1,JMAX                                               NASA  6237
      MODL=INT(DATAB(2,J)+.1)                                       NASA  6238
C                                   CK FOR MODEL TYPE 4             NASA  6239
      IF (MODL.EQ.4) GO TO 160                                      NASA  6240
C                                   MAX NUM OF REDUNDANCIES         NASA  6241
      NMX(J)=DATAB(6,J)+.1                                          NASA  6242
      NMX(J)=NMX(J)-NCHOSE(J)                                       NASA  6243
      SAVMX(J)=NMX(J)                                               NASA  6244
      GO TO (151,152,153,160,155), MODL                             NASA  6245
C                                   MODEL 1                         NASA  6246
  151  DATAB(4,J)=LAMS*1.0E-09                                      NASA  6247
       DATAB(3,J)=DATAB(3,J)*1.0E-09                                NASA  6248
       DATAB(6,J)=DC                                                NASA  6249
      GO TO 160                                                     NASA  6250
C                                   MODEL 2                         NASA  6251
  152  DATAB(3,J)=DATAB(3,J)*1.0E-09                                NASA  6252
       DATAB(4,J)=DATAB(4,J)*1.0E-09                                NASA  6253
      GO TO 160                                                     NASA  6254
C                                   MODEL 3                         NASA  6255
  153  DATAB(6,J)=NC/NCHOSE(J)                                      NASA  6256
      TWOPI=6.2831853                                               NASA  6257
       DATAB(5,J)=NZERC*3600./TWOPI                                 NASA  6258
      DATAB(4,J)= TB                                                123074   1
      DATAB(3,J)= D                                                 123074   2
      GO TO 160                                                     NASA  6263
C                                   MODEL 5                         NASA  6264
  155  DATAB(6,J)=DC                                                NASA  6265
       DATAB(3,J)=DATAB(3,J)*FC                                     NASA  6266
       DATAB(4,J)=LAMS*1.0E-09                                      NASA  6267
160   CONTINUE                                                      NASA  6268
C                                   TIME STEP INCR.                 NASA  6269
      DELH=TRUNC/FLOAT(ITRUNC-1)                                    NASA  6270
C                                   CALCULATE RELIABILITY MATRIX    NASA  6271
      LIM=N(NSS)                                                    NASA  6272
      IF (IDEBUG .EQ. 0) GO TO 165                                  012775  29
      WRITE(6,3000)(NMX(J),J=1,LIM)                                 NASA  6273
      WRITE(6,3000)(NCHOSE(J),J=1,LIM)                              NASA  6274
 3000 FORMAT(6(10I7,/))                                             NASA  6275
      WRITE(6,4000)((DATAB(I,J),I=1,6),J=1,LIM)                     NASA  6276
 4000 FORMAT(6(1X,E16.8))                                           NASA  6277
  165 DO 180 J = 1,LIM                                              012775  30
      IADD=0                                                        NASA  6279
      CALL RIMOD(J,DELH,ITRUNC,ITRUNC,IADD,0)                       NASA  6280
```

```
      DO 170 I=1,ITRUNC                                                 NASA      6281
  170 RI(I,J)=R(I)                                                      NASA      6282
      IF(IDEBUG.EQ.1) PRINT 4000,(R(I),I=1,ITRUNC)                      012775      31
  180 CONTINUE                                                          NASA      6284
C                                           SET EXPENSE OPTION          NASA      6285
      IF (KEOPT.NE.1) GO TO 195                                         NASA      6286
      DO 190 J=1,LIM                                                    NASA      6287
  190 COST(J)=DATAB(1,J)                                                NASA      6288
      GO TO 200                                                         NASA      6289
C                                           COMPUTE COST                NASA      6290
  195 DO 196 J=1,LIM                                                    NASA      6291
  196 COST(J)=COSTM(1,J)+COSTM(2,J)+COSTM(3,J)                          NASA      6292
C                                                                       NASA      6293
C     ................................................................. NASA      6294
C                                                                       NASA      6295
C                        ***   MAIN PROGRAM   ***                       NASA      6296
C                                                                       NASA      6297
C     ................................................................. NASA      6298
C                                                                       NASA      6299
C     R(TRUNC) MODE                                                     NASA      6300
  200 LIM=NSS+1                                                         NASA      6301
C                                           R(TRUC) MODE FOR EACH SUB-SYS NASA    6302
C                                           WITH A USER SPEC.           NASA      6303
C                                           FOR K=LIM SUB-SYS IS TOTAL SYS NASA   6304
      SAVNSR=0                                                          NASA      6305
      JMAX=0                                                            NASA      6306
      DO 270 K=1,LIM                                                    NASA      6307
C                                           CK FOR ANY SUB-SYS  USER SPEC. NASA   6308
C                                             ISUB=2    NO SUB-SYS SPECS. NASA    6309
C                                             ISUB=1    AT LEAST ONE    NASA      6310
C                                                       SUB-SYS SPEC.   NASA      6311
      IF (ISUB .NE. 1 .AND. K .NE. LIM) GO TO 270                       NASA      6312
C                                           SET NUM OF SUB-SYSTEM RED TO 0 NASA   6313
      NSR=0                                                             NASA      6314
C                                           SELECT JMIN AND JMAX        NASA      6315
      IF (K.NE.LIM) GO TO 210                                           NASA      6316
      JMIN=1                                                            NASA      6317
      JMAX=N(NSS)                                                       NASA      6318
      NSR=SAVNSR                                                        NASA      6319
      GO TO 220                                                         NASA      6320
  210 JMIN=JMAX+1                                                       NASA      6321
      JMAX=N(K)                                                         NASA      6322
C                                           CALCULATE MAX NUM SYS RED.  NASA      6323
  220 NSMX=0                                                            NASA      6324
      DO 230 L=JMIN,JMAX                                                NASA      6325
  230 NSMX=NSMX+SAVMX(L)                                                NASA      6326
C                                           CK FOR SUB-SYS USER SPEC    NASA      6327
      IF (SPEC(K).LE.RHO1) GO TO 269                                    NASA      6328
C                                                                       NASA      6329
C                                           SET PARAMETERS FOR REDAP ENTRY NASA   6330
      RHOTH=RHO1                                                        NASA      6331
      NT=1                                                              NASA      6332
      IRTN=1                                                            NASA      6333
C                                           CALCULATE INITIAL SUB-SYS   NASA      6334
C                                           RELIABILITY                 NASA      6335
  250 ROLD(ITRUNC)=RFIXED*RFNL                                          NASA      6336
      DO 240 J=JMIN,JMAX                                                NASA      6337
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```
  240     ROLD(ITRUNC)=ROLD(ITRUNC)*RI(ITRUNC,J)                             NASA     6338
  C                                             CK RELIABILITY AGAINST SPEC.   NASA     6339
  C                                             ENTER  REDAP                   NASA     6340
  C                                                                            NASA     6341
          OLDRHO=-1.0                                                          NASA     6342
          RD(ITRUNC)=1.-(1.-ROLD(ITRUNC))**2                                   NASA     6343
          IF (IDS.EQ.0) GO TO 245                                              NASA     6344
          IF (RD(ITRUNC).LT.SPEC(K)) GO TO 390                                 NASA     6345
          GO TO 255                                                            NASA     6346
      245 IF (ROLD(ITRUNC).LT.SPEC(K)) GO TO 390                               NASA     6347
  C                                                                            NASA     6348
  C                                             UPDATE NMX FOR  K .LT. LIM     NASA     6349
      255 IF (K.EQ.LIM) GO TO 269                                              NASA     6350
          DO 260 J=JMIN,JMAX                                                   NASA     6351
  260     NMX(J)=NR(J)                                                         NASA     6352
      269 SAVNSR=SAVNSR+NSR                                                    NASA     6353
      270 CONTINUE                                                             NASA     6354
  C                                                                            NASA     6355
  C                                             LIST OF EXIT PARAM AND VALUES  NASA     6356
  C                                             EXIT R(TRUNC) MODE             NASA     6357
  C                                                  JMIN=1                    NASA     6358
  C                                                  JMAX=N(NSS)               NASA     6359
  C                                                  NSR= NUM SYS RED          NASA     6360
  C                                                  NSMX= MAX NUM SYS RED     NASA     6361
  C                                             NOW ENTER MMD DETERMINATION    NASA     6362
  C                                             RESET NMX TO TRUE LIMITS       NASA     6363
          DO 280 J=1,JMAX                                                      NASA     6364
  280     NMX(J)=SAVMX(J)                                                      NASA     6365
  C                                                                            NASA     6366
  C   200 ENTRY  TO  MMD DETERMINATION                                         NASA     6367
  C                                                                            NASA     6368
  C                                             CK FOR SINGLE POINT FAILURE    NASA     6369
  C                                             REQUIREMENT                    NASA     6370
  C                                                  ISPT=0      NO REQ.       NASA     6371
  C                                                      =1         REQ.       NASA     6372
          IF (ISPT.EQ.0) GO TO 300                                             NASA     6373
  C                                             SINGLE POINT FAILURE REQ. IN   NASA     6374
  C                                             EFFECT                         NASA     6375
          DO 290 J=1,JMAX                                                      NASA     6376
          IF ((NMX(J).LE.0).OR.(NR(J).GT.0)) GO TO 290                         NASA     6377
          MODL=DATAB(2,J)+.1                                                   NASA     6378
          L=1                                                                  NASA     6379
          IF(MODL.EQ.5) L=NCHOSE(J)                                            NASA     6380
          NSR=NSR+L                                                            NASA     6381
          NR(J)=NR(J)+L                                                        NASA     6382
          IADD=0                                                               NASA     6383
          CALL RIMOD(J,DELH,ITRUNC,ITRUNC,IADD,0)                              NASA     6384
          DO 285 I=1,ITRUNC                                                    NASA     6385
      285 RI(I,J)=R(I)                                                         NASA     6386
  290     CONTINUE                                                             NASA     6387
  C                                                                            NASA     6388
  C                                             INITIALIZATION OF PARAMETERS   NASA     6389
  C                                             BEFORE ENTRY TO THE REDUNDANCY NASA     6390
  C                                             ALLOCATION PROCEDURE           NASA     6391
      300 RHOTH=RHO2                                                           NASA     6392
          NT=ITRUNC                                                            NASA     6393
          IRTN=2                                                               NASA     6394
  C                                             COMPUTE INITIAL RELIABILITY    NASA     6394
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C                                             FNC FOR SINGLE AND DOUBLE       NASA     6395
C                                             STRING SYSTEMS                  NASA     6396
  330     DO 320 I=1,ITRUNC                                                   NASA     6397
          ROLD(I)=RI(I,1)                                                     NASA     6398
          IF (RFNL .GE. 0.999) GO TO 305                                      NASA     6399
          ROLD(I)=ROLD(I)*EXP(-((DELH*FLOAT(I-1))/ALPHA)**1.6)                NASA     6400
   305    DO 310 J=2,JMAX                                                     NASA     6401
  310     ROLD(I)=ROLD(I)*RI(I,J)                                             NASA     6402
          RD(I)=1.-(1.-ROLD(I))**2                                            NASA     6403
  320     CONTINUE                                                            NASA     6404
C                                             COMPUTE INITIAL MMD VALUE       NASA     6405
          CALL QSF (DELH,ROLD,Z,ITRUNC)                                       NASA     6406
          MMDOLD=RFIXED*Z(ITRUNC)                                             NASA     6407
          CALL QSF (DELH,RD,Z,ITRUNC)                                         NASA     6408
          DSMMD=RFIXED*Z(ITRUNC)                                              NASA     6409
C                                                                             NASA     6410
C                                             CK MMDOLD AGAINST USER SPEC1    NASA     6411
C                                             GO TO  REDAP                    NASA     6412
C                                             ALSO RETURN POINT FOR REDAP     NASA     6413
          OLDRHO=-1.0                                                         NASA     6414
          IF(IDS.EQ.0) GO TO 350                                              NASA     6415
          IF(DSMMD.LT.SPEC1) GO TO 390                                        NASA     6416
          GO TO 351                                                           NASA     6417
  350     IF (MMDOLD.LT.SPEC1) GO TO 390                                      NASA     6418
    351   IRTN=0                                                              NASA     6419
C                                           COMPUTE SUBSYS RELIABILITIES      111874     63
          JMAX=0                                                              111874     64
          DO 353 K=1,NSS                                                      111874     65
          JMIN=JMAX+1                                                         111874     66
          JMAX=N(K)                                                           111874     67
          SSREL(K) = 1.0                                                      111874     68
          DO 352 J=JMIN,JMAX                                                  111874     69
    352   SSREL(K)=SSREL(K)*RI(ITRUNC,J)                                      111874     70
    353   CONTINUE                                                            111874     71
C                                           MISSION EQUIPMENT RELIABILITY     111874     72
          SSREL(6) = RFNL                                                     111874     73
C                                             COMPRESS NCHOSE AND ADD RED.    NASA     6420
  360     JMIN=N(2)-1                                                         NASA     6421
          DO 370 J=1,JMIN                                                     NASA     6422
  370     NCHOSE(J)=NCHOSE(J)+NR(J)                                           NASA     6423
          JMIN=N(2)                                                           NASA     6424
          JMAX=N(NSS)                                                         NASA     6425
          DO 380 J=JMIN,JMAX                                                  NASA     6426
  380     NCHOSE(J)=NCHOSE(J+1)+NR(J+1)                                       NASA     6427
C                                             EXPENDABLES INFO RETURN         NASA     6428
          TPRIM=TPRIM+FLOAT(3*NR(JMIN))                                       NASA     6429
          PRINT 1000,TPRIM                                                    110774      2
   1000   FORMAT (1X,6HTPRIM=,E11.4)                                          110774      3
          PRINT 1100,D                                                        123074      3
   1100   FORMAT(1X,2HD=,E11.4)                                               123074      4
          ITRUNP=ITRUNC                                                       NASA     6430
          IF (IDS .EQ. 0) GO TO 385                                           NASA     6431
          MMDOLD=DSMMD                                                        NASA     6432
          ROLD(ITRUNC)=RD(ITRUNC)                                             NASA     6433
          DO 381 J=1,JMAX                                                     120474     18
    381   NCHOSE(J) = NCHOSE(J) * 2                                           120474     19
   385    RETURN                                                              NASA     6434
```

```
C      ...........................................................  NASA   6435
C                                                                   NASA   6436
C           ***   MAIN REDUNDANCY ALLOCATION PROCEDURE   ***        NASA   6437
C                               (REDAP)                             NASA   6438
C                                                                   NASA   6439
C      ...........................................................  NASA   6440
C                                      IF MAX NUM RED EXCEEDED, RETRN NASA 6441
C                                      OTHERWISE CONTINUE PROCEDURE NASA   6442
C                                                                   NASA   6443
390    IF (NSR.GE.NSMX) GO TO (490,510), IRTN                       NASA   6444
C                                                                   NASA   6445
C                                      SELECT MODULE TO ADD A RED, IF NASA 6446
C                                      J.GE.JMAX GO TO SYS UPDATE   NASA   6447
C                                      PROCEDURE.                   NASA   6448
       DO 440 J=JMIN,JMAX,1                                         NASA   6449
       IF (NR(J).GE.NMX(J)) GO TO 440                               NASA   6450
       MODL=DATAB(2,J)+.1                                           NASA   6451
       IF ((MODL.EQ.3).AND.(NR(J+1).GE.NMX(J+1))) GO TO 440         NASA   6452
C                                      ADD A RED TO MODULE AND      NASA   6453
C                                      COMPUTE THE RELIABILITY FNC  NASA   6454
       IADD=1                                                       NASA   6455
       CALL RIMOD(J,DELH,ITRUNC,NT,IADD,1)                          NASA   6456
C                                      CALCULATE NEW SYS RELIABILITY NASA  6457
       DO 400 IND=1,NT                                              NASA   6458
       I=ITRUNC+1-IND                                               NASA   6459
       RNEW(I)=ROLD(I)*R(I)/RI(I,J)                                 NASA   6460
400    CONTINUE                                                     NASA   6461
C                                      CK FOR R(TRUNC) OR MMD       NASA   6462
C                                      COMPUTATIONAL MODE           NASA   6463
       IF (NT.NE.1) GO TO 410                                       NASA   6464
C                                      R(ITRUNC) MODE               NASA   6465
       I=ITRUNC                                                     NASA   6466
       RHO=(ABS(RNEW(I)-ROLD(I)))/COST(J)                           NASA   6467
       GO TO 420                                                    NASA   6468
C                                      MMD MODE                     NASA   6469
410    CALL QSF (DELH,RNEW,Z,ITRUNC)                                NASA   6470
       MMDNEW=Z(ITRUNC)*RFIXED                                      NASA   6471
       RHO=(ABS(MMDNEW-MMDOLD))/COST(J)                             NASA   6472
C                                      SELECTION, DECISION SEQUENCE NASA   6473
C                                                                   NASA   6474
420    IF (RHO.LT.OLDRHO) GO TO 440                                 NASA   6475
C                                      RHO.LT.OLDRHO  SAVE CURRENT  NASA   6476
C                                      RELIABILITY DATA, MODULE NUM, NASA  6477
C                                      AND VALUE OF RHO.            NASA   6478
       JSAVE=J                                                      NASA   6479
       OLDRHO=RHO                                                   NASA   6480
       PRINT 422,JSAVE,OLDRHO,RNEW(ITRUNC)                          102374    2
  422  FORMAT (1X,I5,1X,2(E11.4,1X))                                102374    3
       DO 430 IND=1,NT                                              NASA   6481
       I=ITRUNC+1-IND                                               NASA   6482
       SAVR(I)=R(I)                                                 NASA   6483
430    CONTINUE                                                     NASA   6484
       IF (NT.NE.1) SAVMMD=MMDNEW                                   NASA   6485
440    CONTINUE                                                     NASA   6486
       IF (OLDRHO.LT.RHOTH) GO TO (530,540), IRTN                   NASA   6487
C                                                                   NASA   6488
C                    ***   END REDAP   ***                          NASA   6489
```

```
C                                                                              NASA      6490
C     .......................................................................  NASA      6491
C                                                                              NASA      6492
C      ***    SYSTEM RELIABILITY UPDATE PROCEDURE    ***                       NASA      6493
C                             (SYRUP)                                          NASA      6494
C                                                                              NASA      6495
C                                                                              NASA      6496
      MODL=DATAB(2,JSAVE)+.1                                                   NASA      6497
      L=1                                                                      NASA      6498
      IF (MODL.EQ.5) L=NCHOSE(JSAVE)                                           NASA      6499
      NSR=NSR+L                                                                NASA      6500
      NR(JSAVE)=NR(JSAVE)+L                                                    NASA      6501
      IF(MODL.NE.4) GO TO 449                                                  NASA      6502
      SYSLB=SYSLB+DATAB(1,JSAVE)/(TPRIM+FLOAT(3*NR(JSAVE)))                    NASA      6503
      GO TO 450                                                                NASA      6504
  449 SYSLB=SYSLB+DATAB(1,JSAVE)*FLOAT(L)                                      NASA      6505
      IF (MODL.NE.3) GO TO 450                                                 NASA      6506
      XNR = FLOAT(NR(JSAVE)+NCHOSE(JSAVE))                                     123074       5
      D = D * (XNR-1.)/XNR                                                     123074       6
      DATAB(3,JSAVE) = D                                                       123074       7
      NSR=NSR+1                                                                NASA      6507
      NR(JSAVE+1)=NR(JSAVE+1)+1                                                NASA      6508
      SYSLB=SYSLB+DATAB(1,JSAVE+1)                                             NASA      6509
      IADD=0                                                                   NASA      6510
      CALL RIMOD(JSAVE+1,DELH,ITRUNC,ITRUNC,IADD,0)                            NASA      6511
      DO 452 I=1,ITRUNC                                                        NASA      6512
  452 RI(I,JSAVE+1)=R(I)                                                       NASA      6513
  450 IF (NT .NE. 1) GO TO 455                                                 NASA      6514
      IADD=0                                                                   NASA      6515
      CALL RIMOD(JSAVE,DELH,ITRUNC,ITRUNC,IADD,0)                              NASA      6516
      DO 451 I=1,ITRUNC                                                        NASA      6517
  451 SAVR(I)=R(I)                                                             NASA      6518
455   DO 460 I=1,ITRUNC                                                        NASA      6519
      RI(I,JSAVE)=SAVR(I)                                                      NASA      6520
460   CONTINUE                                                                 NASA      6521
C                                             EXIT IF SYS WEIGHT EXCEEDED.     NASA      6530
      IF (SYSLB .GE. SLBMX)  GO TO (500,520), IRTN                             011675      35
C                                                                              NASA      6532
C                                             BRANCH TO START ANOTHER PASS     NASA      6533
C                                             THRU REDAP(                      NASA      6534
C                                               MODE          NT     STMT NUM  NASA      6535
C                                             R(ITRUNC)        1        250    NASA      6536
C                                               MMD         ITRUNC      330    NASA      6537
      IF (NT.NE.1) GO TO 330                                                   NASA      6538
      GO TO 250                                                                NASA      6539
C                                                                              NASA      6540
C                   ***   END SYRUP   ***                                      NASA      6541
C                                                                              NASA      6542
C     .......................................................................  NASA      6543
C                                                                              NASA      6544
C                 ***   PROGRAM RETURNS   ***                                  NASA      6545
C                                                                              NASA      6546
C                                                                              NASA      6547
490   IRTN=-1                                                                  NASA      6548
      GO TO 360                                                                NASA      6549
500   IRTN=-2                                                                  NASA      6550
      GO TO 360                                                                NASA      6551
```

```
              510   IRTN=-3                                                                      NASA      6552
                    GO TO 360                                                                    NASA      6553
  570         520   IRTN=-4                                                                      NASA      6554
                    GO TO 360                                                                    NASA      6555
              530   IRTN=-5                                                                      NASA      6556
                    GO TO 360                                                                    NASA      6557
              540   IRTN=-6                                                                      NASA      6558
  575               GO TO 360                                                                    NASA      6559
              C                                                                                  NASA      6560
                    END                                                                          NASA      6561
SUMMARY OF CHANGES MADE BY THE OPTIMIZER
13    WORDS OF INVARIANT RLIST REMOVED FROM THE LOOP BEGINNING AT LINE 477
13    WORDS OF INVARIANT RLIST REMOVED FROM THE LCOP BEGINNING AT LINE 502
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      SUBROUTINE RIMCD(J,DELH,ITRUNC,NT,IADD,IOPT)                      NASA      6563
      COMMON /DBCOM/  R(31),NR(60),RI(31,60),W(31),RD(31),RDUM(31),     022575     615
     *                SAVR(31),SAVNRW(31),RNEW(31),NMX(60),SAVMX(60),   022575     616
     *                COST(60),DUM(3213)                                022575     617
C                                                                       022575     618
      COMMON /CHOSE/     COSTM(5,60),      DPIA(11,60),     ICHCSE(60), 022575     619
     1                   NCHOSE(60),  SYSPAR ( 6,60),    SKD(7,60),     022575     620
     2                   THM(4,60)                                      022575     621
C                                                                       022575     622
      COMMON/PRTCOM/    ACCRCY,          AM,          AN,        BF,        BS, 022575 623
     1               CDPI(7,2),    CISTAR,        CTOT,      DDTE,        DE, 022575 624
     2                   DRIWT,    EQBSTR,      FEEINV,    FEEOPS,      FEER, 022575 625
     3                     GSE,      IREL,      ITRUNP,  MMDOLD,NAME(3,60), 022575 626
     4                     OPS,    PAYINV,      PAYQUL,      PAYR,        PE, 022575 627
     5                     PMP,       PMR,    POWER(6),        PU,   PWR(60), 022575 628
     6                     QCP,       QCR,    ROLD(60),    SABMWT,    SATADP, 022575 629
     7                  SATINV,      SATR,        SEIP,      SEIR,  SKTAU(6), 022575 630
     8                SSREL(6),   SUBE(7),     SUBT(7),   SUBUE(7),  SUBUP(7), 022575 631
     9                      TA,  TAU(6,6),       XDUM1,        TC,        TE, 022575 632
     A                      TF,     TOOLR,       TOOLU,    TOTOPS,     TRUNC, 022575 633
     B                      TS,       TTT,VOLUME(6),   VQL(60),WEIGHT(6), 022575 634
     C                  XLTOT,       XMEH,      XMEINV,      XMEL,     XMEVL, 022575 635
     D                   XMEW,     XMEWT,       XVEST                        022575 636
      REAL LAM,LAMBAR,LAMS                                              NASA      6573
C                                                                       NASA      6574
C     ..............................................................    NASA      6575
C                                                                       NASA      6576
C        SUBROUTINE RIMOD                                               NASA      6577
C                                                                       NASA      6578
C        PURPOSE                                                        NASA      6579
C           TO COMPUTE THE RELIABILITY FUNCTION FOR MODULE J AFTER      NASA      6580
C           REDUNDANCIES ARE ADDED TO THE MODULE.                       NASA      6581
C                                                                       NASA      6582
C        USAGE                                                          NASA      6583
C           CALL RIMCD(R,NR,J,DELH,ITRUNC,NT,IADD,IOFT)                 NASA      6584
C                                                                       NASA      6585
C        DESCRIPTION OF PARAMETERS                                      NASA      6586
C           J      -INPUT MODULE NUM                                    NASA      6587
C           DELH   -DELTA TIME, THE TIME INCREMENT                      NASA      6588
C           ITRUNC -THE NUM OF TIME POINTS                              NASA      6589
C           NT     -INPUT OPTION PARAMETER                              NASA      6590
C           IADD   -INPUT OPTION PARAMETER                              NASA      6591
C           IOPT   -INPUT OPTION PARAMETER                              NASA      6592
C                                                                       NASA      6593
C        REMARKS                                                        NASA      6594
C           OPTION PARAMETER   VALUE      ACTION                        NASA      6595
C                  NT            1        ONLY COMPUTE RELIABILITY AT   NASA      6596
C                                         TRUNCATION TIME. RETURN VALUE IN NASA   6597
C                                         R(ITRUNC).                    NASA      6598
C                              ITRUNC     COMPUTE RELIABILITY AT EACH TIME NASA   6599
C                                         RETURN VALUES IN R.           NASA      6600
C                 IADD           0        ADD NO REDUNDANCIES BEFORE COM- NASA    6601
C                                         PUTING THE RELIABILITY FUNCTION. NASA   6602
C                                1        ADD REDUNDANCIES BEFORE COMPUT- NASA    6603
```

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C                                       ING THE RELIABILITY FUNCTION.      NASA      6604
C                 IOFT           0      UNCOUPLE MODELS 1 AND 3.           NASA      6605
C                                                                          NASA      6606
C                               OTHER   COUPLE MODELS 1 AND 3.             NASA      6607
C                                                                          NASA      6608
C        GLOBAL VARIABLES PASSED THOUGH COMMON                             NASA      6609
C           R       -THE RESULTING RELIABILITY FUNCTION                    NASA      6610
C           NR      -INPUT VECTOR OF THE NUM OF REDUNDANCIES BY MODULE     NASA      6611
C           NCHOS   -INITIAL NUM OF ELEMENTS IN MODULES                    NASA      6612
C           SYSPAR  -MATRIX OF MODEL PAFAMETERS                            NASA      6613
C                    SYSPAR(2,J)= MODEL ID FOR J-TH MODULE                 NASA      6614
C                    FOR FURTHER DESCRIFTION SEE COMMENTS PRECEEDING THE   NASA      6615
C                    PARTICULAR MODEL OF INTEREST.                         NASA      6616
C                                                                          NASA      6617
C        SUBROUTINES AND SUBPROGRAMS REQUIRED                              NASA      6618
C           FORTRAN SYS FNCS: EXP, FLOAT, INT, SQRT                        NASA      6619
C           EXTERNAL FNCS: GAM=GAMMA FNC, CERF=ERROR FNC                   NASA      6620
C           SUBROUTINES: NONE                                              NASA      6621
C                                                                          NASA      6622
C     ......................................................................NASA      6623
C                                                                          NASA      6624
      ROOT2=SQRT(2.0)                                                      NASA      6625
      MOD=INT(SYSPAR(2,J)+.1)                                              NASA      6626
      GO TO (10,90,120,160,10), MOD                                        NASA      6627
C     ......................................................................NASA      6628
C     MODELS 1 AND 5                                                       NASA      6629
C                                                                          NASA      6630
C        VARIABLES    SIZE     ORIGIN      DEFN                            NASA      6631
C                                                                          NASA      6632
C          LAMS         1        INT       SENSE/SWITCH FAILURE RATE       NASA      6633
C           LAM         1        INT       FAILURE RATE                    NASA      6634
C            Q          1        INT       DORMANCY FACTOR                 NASA      6635
C           DC          1        INT       MODULE DUTY CYCLE               NASA      6636
C           MI          1        INT       NUM OF STANDBY ELEMENTS         NASA      6637
C           NI          1        INT       NUM OF ACTIVE ELEMENTS          NASA      6638
C         SYSPAR       I,J     GLOBAL      MODEL PARAMETERS FOR J-TH       NASA      6639
C                                          MODULE                          NASA      6640
C                                          I=3    VALUE OF LAM             NASA      6641
C                                          I=4    VALUE OF LAMS            NASA      6642
C                                          I=5    VALUE OF Q               NASA      6643
C                                          I=6    VALUE OF DC              NASA      6644
C                                                                          NASA      6645
C     ......................................................................NASA      6646
C                                                                          NASA      6647
10    LAM=SYSPAR(3,J)                                                      NASA      6648
      LAMS=SYSPAR(4,J)                                                     NASA      6649
      Q=SYSPAR(5,J)                                                        NASA      6650
      DC=SYSPAR(6,J)                                                       NASA      6651
      NREQ=NCHOSE(J)                                                       NASA      6652
      NRED=NR(J)                                                           NASA      6653
C                                          CK MODEL TYPE                   NASA      6654
      IF (MOD .EQ. 1) GO TO 15                                             NASA      6655
      NREQ=1                                                               NASA      6656
      NRED=NRED/NCHOSE(J)                                                  NASA      6657
      LAM=LAM*FLOAT(NCHOSE(J))                                             NASA      6658
C                                          CK INCR MODE    IQ=1 ACTIVE     NASA      6659
C                                                     OTHERWISE STDBY      NASA      6660
```

```
   15 IQ=INT(Q+.1)                                                      NASA      6661
      IF (IQ.NE.1) GO TO 20                                             NASA      6662
C                                             INCR IN ACTIVE MODE       NASA      6663
      NI=NREQ+NRED+IADD                                                 NASA      6664
      MI=0                                                              NASA      6665
      GO TO 30                                                          NASA      6666
C                                             INCR IN STANDBY MODE      NASA      6667
20    NI=NREQ                                                           NASA      6668
      MI=NRED+IADD                                                      NASA      6669
C                                             CALCULATION OF MODEL CONSTANTS NASA 6670
30    IF (MI.NE.0) Q=Q+LAMS/LAM                                         NASA      6671
      QBAR=Q/(DC+(1.-DC)*Q)                                             NASA      6672
      LAMBAR=LAM*(DC+(1.-DC)*Q)                                         NASA      6673
C                                                                       NASA      6674
C               ****  COMPUTATION OF RELIABILITIES  ****                NASA      6675
C                                                                       NASA      6676
C                                             INITIALIZATIONS           NASA      6677
      LIM=NREQ                                                          NASA      6678
      LIM2=LIM-1                                                        NASA      6679
      DO 80 IND=1,NT                                                    NASA      6680
C                                             DO FOR EACH TIME POINT, IN NASA     6681
C                                             DESCENDING ORDER, NT TO 1  NASA     6682
      I=ITRUNC+1-IND                                                    NASA      6683
      TIME=DELH*FLOAT(I-1)                                              NASA      6684
C                                               SUM0 ACCUMULATES RELIABILITY NASA 6685
      SUM0=1.0                                                          NASA      6686
C                                             EXPONENTIAL CONSTANT      NASA      6687
C                                                                       NASA      6688
      EC1=EXP(-LAMBAR*TIME*FLOAT(NI))                                   NASA      6689
C                                                                       NASA      6690
C                                             CALCULATE PROBABILITIES, IN NASA    6691
C                                             DESCENDING ORDER, LIM-1 TO 0. NASA  6692
      DO 70 IND2=1,LIM                                                  NASA      6693
      K=LIM-IND2                                                        NASA      6694
      SUM2=0.0                                                          NASA      6695
      SUM1=0.0                                                          NASA      6696
C                                             COMPUTE FIRST SUMMATION   NASA      6697
      KLIM=K+1                                                          NASA      6698
      NILIM=NI+1                                                        NASA      6699
      DO 40 INDD=KLIM,NILIM                                             NASA      6700
      IND3=INDD-1                                                       NASA      6701
      ARG1=1.+FLOAT(IND3-K)                                             NASA      6702
      ARG2=FLOAT(NI-IND3)                                               NASA      6703
      ARG3=1.+ARG2/QBAR                                                 NASA      6704
      BK=GAM(ARG1)*GAM(ARG2+1.)*GAM(ARG3+FLOAT(MI))/GAM(ARG3)           NASA      6705
      IF ((IND3-2*(IND3/2)).EQ.1) BK=-BK                                NASA      6706
      Z=EXP(-LAMBAR*TIME*FLOAT(IND3))                                   NASA      6707
40    SUM1=SUM1+Z/BK                                                    NASA      6708
C                                             COMPUTE SECOND SUMMATION  NASA      6709
      IF (MI.EQ.0) GO TO 60                                             NASA      6710
      DO 50 IND3=1,MI                                                   NASA      6711
      ARG1=FLOAT(IND3)                                                  NASA      6712
      ARG2=1.+FLOAT(MI-IND3)                                            NASA      6713
      ARG3=1.+ARG1*QBAR                                                 NASA      6714
      CJ=GAM(ARG1+1.)*GAM(ARG2)*GAM(ARG3+FLOAT(NI-K))/GAM(ARG3)         NASA      6715
      ICK=NI+IND3                                                       NASA      6716
      IF ((ICK-2*(ICK/2)).EQ.1) CJ=-CJ                                  NASA      6717
```

```
      Z=EXP(-Q*LAM*TIME*ARG1)                                           NASA  6718
   50 SUM2=SUM2+Z/CJ                                                    NASA  6719
C                                                                       NASA  6720
C                                 CALCULATION OF PROBABILITY            NASA  6721
C                                      PR(K)=A(K)*SUMS                  NASA  6722
C                                                                       NASA  6723
   60 SUM2=SUM1+EC1*SUM2                                                NASA  6724
      ARG1=FLOAT(NI)                                                    NASA  6725
      ARG2=1.+FLOAT(K)                                                  NASA  6726
      ARG3=1.+ARG1/QBAR                                                 NASA  6727
      AK=GAM(ARG1+1.)*GAM(ARG3+FLOAT(MI))/(GAM(ARG2)*GAM(ARG3))         NASA  6728
      IF ((K-2*(K/2)).EQ.1) AK=-AK                                      NASA  6729
C                                                                       NASA  6730
C                                 ACCUMULATE  RELIABILITY               NASA  6731
C                                                                       NASA  6732
      SUM0=SUM0-AK*SUM2                                                 NASA  6733
   70 CONTINUE                                                          NASA  6734
C                                                                       NASA  6735
C                                 CK COUPLING OPTION                    NASA  6736
C                                 ASSIGN RELIABILITY AND INCR           NASA  6737
C                                 TIME                                  NASA  6738
      IF (MOD.EQ.3) SUM0=SUM0*R(I)                                      NASA  6739
   80 R(I)=SUM0                                                         NASA  6740
C                                 CK COUPLING OPTION                    NASA  6741
      IF (MOD.EQ.3) J=J-1                                               NASA  6742
      RETURN                                                            NASA  6743
C                                                                       NASA  6744
C     ....................................................................NASA  6745
C                                                                       NASA  6746
C     MODEL2                                                            NASA  6747
C        VARIABLES       SIZE     ORIGIN        DEFN                    NASA  6748
C                                                                       NASA  6749
C           FMU           SC       LOCAL        MEAN UNIT LIFE          NASA  6750
C           FSIG          SC       LOCAL        STD. DEV.               NASA  6751
C         SYSPAR          I,J      GLOBAL       MODEL PARAMETERS FOR J-TH NASA  6752
C                                               MODULE                  NASA  6753
C                                               I=3   VALUE OF FMU      NASA  6754
C                                               I=4   VALUE OF FSIG     NASA  6755
C             NI          SC       LOCAL        TOTAL NUM OF ELEMENTS   NASA  6756
C                                                                       NASA  6757
C     ....................................................................NASA  6758
C                                                                       NASA  6759
   90 FMU=SYSPAR(3,J)                                                   NASA  6760
      FSIG=SYSPAR(4,J)                                                  NASA  6761
C                                 INCR REDUND.                          NASA  6762
      LIM=NR(J)+IADD                                                    NASA  6763
      NI=LIM+NCHOSE(J)                                                  NASA  6764
      LIM2=LIM-1                                                        NASA  6765
C                                 COMPUTE NEW RELIABILITIES             NASA  6766
C                                                                       NASA  6767
      DO 110 I=1,NT                                                     NASA  6768
      K=ITRUNC+1-I                                                      NASA  6769
      Z=((DELH*(K-1))-FMU)/(ROOT2*FSIG)                                 NASA  6770
      AN=CERF(ABS(Z))                                                   NASA  6771
      IF (ABS(Z).GT.4.0) AN=1.-AN                                       NASA  6772
      AN=0.5*(1.-AN)                                                    NASA  6773
      IF (Z.LT.0.0) AN=1.-AN                                            NASA  6774
```

```
C                                                                        NASA     6775
C                                          COMPUTATION OF CUMULATIVE     NASA     6776
C                                          BINOMIAL PROBABILITIES        NASA     6777
C                                                                        NASA     6778
      Z=AN                                                               NASA     6779
      AN=AN**NI                                                          NASA     6780
      SUM=AN                                                             NASA     6781
      IF (LIM.EQ.0) GO TO 110                                            NASA     6782
      Z=(1.-Z)/Z                                                         NASA     6783
      LLLIM=LIM2+1                                                       NASA     6784
      DO 100 LLL=1,LLLIM                                                 NASA     6785
      L=LLL-1                                                            NASA     6786
      AN=AN*(FLOAT(NT-L)/FLOAT(L+1))*Z                                   NASA     6787
100   SUM=SUM+AN                                                         NASA     6788
110   R(K)=SUM                                                           NASA     6789
      RETURN                                                             NASA     6790
C                                                                        NASA     6791
C     ...............................................................   NASA     6792
C                                                                        NASA     6793
C     MODEL3(                                                            NASA     6794
C        VARIABLES     SIZE     ORIGIN      DEFN                         NASA     6795
C                                                                        NASA     6796
C           D          SC       LOCAL       DEPTH OF DISCHARGE           123074      8
C           TB         SC       LOCAL       BATTERY TEMPERATURE          123074      9
C           AB         SC       LOCAL       BATTERY CELL CONSTANT        NASA     6797
C           BB         SC       LOCAL       BATTERY CELL CONSTANT        NASA     6798
C           BCYC       SC       LOCAL       CYCLE RATE OF BATTERY        NASA     6799
C           NI         SC       LOCAL       TOTAL NUM OF BATTERIES       NASA     6800
C           NC         SC       LOCAL       NUM OF CELLS IN BATTERY      NASA     6801
C         SYSPAR       I,J      GLOBAL      MODEL PARAMETERS FOR J-TH    NASA     6802
C                                           MODULE                       NASA     6803
C                                           I=3   VALUE OF D             123074     10
C                                           I=4   VALUE OF TB            123074     11
C                                           I=5   VALUE OF BCYC          NASA     6806
C                                           I=6   VALUE OF NC            NASA     6807
C                                                                        NASA     6808
C     ...............................................................   NASA     6809
C                                                                        NASA     6810
  120 BCYC = SYSPAR(5,J)                                                 123074     12
      NC=SYSPAR(6,J)+.1                                                  NASA     6814
C                                           INCR REDUND.                 NASA     6815
      LIM=NR(J)+IADD                                                     NASA     6816
      NI=LIM+NCHOSE(J)                                                   NASA     6817
      LIM2=LIM-1                                                         NASA     6818
      D = SYSPAR(3,J) * FLOAT(NI-IADD) / FLOAT(NI)                       123074     13
      TB = SYSPAR(4,J)                                                   022675      8
      LIM3=NC/2                                                          NASA     6819
      NC=NC+LIM3                                                         NASA     6820
      AB=EXP(-11.380958+.23896921*TB-.54986583*D-.00050646174*TB*TB      123074     14
     1  +.019307737*D*D-.0002374105*D**3)                                123074     15
      BB=EXP(-138.10332+.95927099*TB-.18704227*D-.0016717786*TB*TB       123074     16
     1  -.0019619976*D*D+.0011242688*TB*D)                               123074     17
C                                           COMPUTE NEW RELIABILITIES    NASA     6821
C                                                                        NASA     6822
      DO 140 I=1,NT                                                      NASA     6823
      K=ITRUNC+1-I                                                       NASA     6824
      Z=(DELH*(K-1)-87660.)/(17532.*ROOT2)                               111274     13
```

```
      AN=CERF(ABS(Z))                                                   NASA      6826
      IF (ABS(Z).GT.4.0) AN=1.-AN                                       NASA      6827
      AN=0.5*(1.-AN)                                                    NASA      6828
      IF (Z.LT.0.0) AN=1.-AN                                            NASA      6829
      Z=EXP(-((BCYC*(DELH*(K-1)))/AB)**BB)                              NASA      6830
      LLLIM=LIM3                                                        NASA      6831
      AA=Z**NC                                                          NASA      6832
      SUM=AA                                                            NASA      6833
      Z=(1.-Z)/Z                                                        NASA      6834
      DO 125 LLL=1,LLLIM                                                NASA      6835
      L=LLL-1                                                           NASA      6836
      AA=AA*(FLOAT(NC-L)/FLOAT(L+1))*Z                                  NASA      6837
  125 SUM=SUM+AA                                                        NASA      6838
      Z=SUM*AN                                                          NASA      6839
C                                                                       NASA      6840
C                                     COMPUTATION OF CUMULATIVE         NASA      6841
C                                     BINOMIAL PROBABILITIES            NASA      6842
      AN=Z**NI                                                          NASA      6843
      SUM=AN                                                            NASA      6844
      IF (LIM.EQ.0) GO TO 140                                           NASA      6845
      Z=(1.-Z)/Z                                                        NASA      6846
      LLLIM=LIM2+1                                                      NASA      6847
      DO 130 LLL=1,LLLIM                                                NASA      6848
      L=LLL-1                                                           NASA      6849
      AN=AN*(FLOAT(NI-L)/FLOAT(L+1))*Z                                  NASA      6850
  130 SUM=SUM+AN                                                        NASA      6851
  140 R(K)=SUM                                                          NASA      6852
C                                     CK COUPLING OPTION                NASA      6853
      IF (IOPT.EQ.0) GO TO 150                                          NASA      6854
      J=J+1                                                             NASA      6855
      GO TO 10                                                          NASA      6856
  150 RETURN                                                            NASA      6857
C                                                                       NASA      6858
C     ..............................................................    NASA      6859
C                                                                       NASA      6860
C     MODEL4                                                            NASA      6861
C        VARIABLES     SIZE     CRIGIN     DEFN                         NASA      6862
C                                                                       NASA      6863
C          FMU          SC      LOCAL      MEAN EXPENABLE DEPLETION TIME NASA     6864
C          FSIG         SC      LOCAL      STD. DEV. OF DEPLETION TIME  NASA      6865
C        SYSPAR         I,J     GLOBAL     MODEL PARAMETERS FOR J-TH    NASA      6866
C                                          MODULE                       NASA      6867
C                                          I=3   INITIAL VALUE OF MU    NASA      6868
C                                          I=4   INITIAL VALUE OF SIG   NASA      6869
C                                          I=5   INCR. VALUE OF MU      NASA      6870
C                                          I=6   INCR. VALUE OF SIG     NASA      6871
C                                                                       NASA      6872
C     ..............................................................    NASA      6873
C                                                                       NASA      6874
C                                          INCR REDUND.                 NASA      6875
C                                                                       NASA      6876
  160 Z=FLOAT(NR(J)+IADD)                                               NASA      6877
      FMU=SYSPAR(3,J)+Z*SYSPAR(5,J)                                     NASA      6878
      FSIG=SQRT((SYSPAR(4,J)**2)+Z*(SYSPAR(6,J)**2))                    NASA      6879
C                                                                       NASA      6880
C                                          COMPUTE NEW RELIABILITIES    NASA      6881
C                                                                       NASA      6882
```

```
 340            DO 170 I=1,NT                                   NASA    6883
                K=ITRUNC+1-I                                    NASA    6884
                Z=((DELH*(K-1))-FMU)/(ROOT2*FSIG)               NASA    6885
                R(K)=CERF(ABS(Z))                               NASA    6886
                IF (ABS(Z).GT.4.0) R(K)=1.0-R(K)                NASA    6887
 345            R(K)=0.5*(1.-R(K))                              NASA    6888
                IF (Z.LT.0.0) R(K)=1.-R(K)                      NASA    6889
          170   CONTINUE                                        NASA    6890
                RETURN                                          NASA    6891
                END                                             NASA    6892

REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 236
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 292
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 305
```

```
      SUBROUTINE QSF(H,Y,Z,NDIM)
C
C     ...................................................................
C
C        SUBROUTINE QSF
C
C        PURPOSE
C           TO COMPUTE THE VECTOR OF INTEGRAL VALUES FOR A GIVEN
C           EQUIDISTANT TABLE OF FUNCTION VALUES.
C
C        USAGE
C           CALL QSF (H,Y,Z,NDIM)
C
C        DESCRIPTION OF PARAMETERS
C           H      - THE INCREMENT OF ARGUMENT VALUES.
C           Y      - THE INPUT VECTOR OF FUNCTION VALUES.
C           Z      - THE RESULTING VECTOR OF INTEGRAL VALUES. Z MAY BE
C                    IDENTICAL WITH Y.
C           NDIM   - THE DIMENSION OF VECTORS Y AND Z.
C
C        REMARKS
C           NO ACTION IN CASE NDIM LESS THAN 3.
C
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
C           NONE
C
C        METHOD
C           BEGINNING WITH Z(1)=0, EVALUATION OF VECTOR Z IS DONE BY
C           MEANS OF SIMPSONS RULE TOGETHER WITH NEWTONS 3/8 RULE OR A
C           COMBINATION OF THESE TWO RULES. TRUNCATION ERROR IS OF
C           ORDER H**5 (I.E. FOURTH ORDER METHOD). ONLY IN CASE NDIM=3
C           TRUNCATION ERROR OF Z(2) IS OF ORDER H**4.
C           FOR REFERENCE, SEE
C           (1) F.B.HILDEBRAND, INTRODUCTION TO NUMERICAL ANALYSIS,
C               MCGRAW-HILL, NEW YORK/TORONTO/LONDON, 1956, PP.71-76.
C           (2) R.ZURMUEHL, PRAKTISCHE MATHEMATIK FUER INGENIEURE UND
C               PHYSIKER, SPRINGER, BERLIN/GOETTINGEN/HEIDELBERG, 1963,
C               PP.214-221.
C
C     ...................................................................
C
C
C
      DIMENSION Y(1),Z(1)
C
      HT=.3333333*H
      IF(NDIM-5)7,8,1
C
C     NDIM IS GREATER THAN 5. PREPARATIONS OF INTEGRATION LOOP
    1 SUM1=Y(2)+Y(2)
      SUM1=SUM1+SUM1
      SUM1=HT*(Y(1)+SUM1+Y(3))
      AUX1=Y(4)+Y(4)
      AUX1=AUX1+AUX1
```

```
      AUX1=SUM1+HT*(Y(3)+AUX1+Y(5))                                    NASA   6947
      AUX2=HT*(Y(1)+3.875*(Y(2)+Y(5))+2.625*(Y(3)+Y(4))+Y(6))          NASA   6948
      SUM2=Y(5)+Y(5)                                                   NASA   6949
      SUM2=SUM2+SUM2                                                   NASA   6950
      SUM2=AUX2-HT*(Y(4)+SUM2+Y(6))                                    NASA   6951
      Z(1)=0.                                                          NASA   6952
      AUX=Y(3)+Y(3)                                                    NASA   6953
      AUX=AUX+AUX                                                      NASA   6954
      Z(2)=SUM2-HT*(Y(2)+AUX+Y(4))                                     NASA   6955
      Z(3)=SUM1                                                        NASA   6956
      Z(4)=SUM2                                                        NASA   6957
      IF(NDIM-6)5,5,2                                                  NASA   6958
C                                                                      NASA   6959
C     INTEGRATION LOOP                                                 NASA   6960
    2 DO 4 I=7,NDIM,2                                                  NASA   6961
      SUM1=AUX1                                                        NASA   6962
      SUM2=AUX2                                                        NASA   6963
      AUX1=Y(I-1)+Y(I-1)                                               NASA   6964
      AUX1=AUX1+AUX1                                                   NASA   6965
      AUX1=SUM1+HT*(Y(I-2)+AUX1+Y(I))                                  NASA   6966
      Z(I-2)=SUM1                                                      NASA   6967
      IF(I-NDIM)3,6,6                                                  NASA   6968
    3 AUX2=Y(I)+Y(I)                                                   NASA   6969
      AUX2=AUX2+AUX2                                                   NASA   6970
      AUX2=SUM2+HT*(Y(I-1)+AUX2+Y(I+1))                                NASA   6971
    4 Z(I-1)=SUM2                                                      NASA   6972
    5 Z(NDIM-1)=AUX1                                                   NASA   6973
      Z(NDIM)=AUX2                                                     NASA   6974
      RETURN                                                           NASA   6975
    6 Z(NDIM-1)=SUM2                                                   NASA   6976
      Z(NDIM)=AUX1                                                     NASA   6977
      RETURN                                                           NASA   6978
C     END OF INTEGRATION LOOP                                          NASA   6979
C                                                                      NASA   6980
    7 IF(NDIM-3)12,11,8                                                NASA   6981
C                                                                      NASA   6982
C     NDIM IS EQUAL TO 4 OR 5                                          NASA   6983
    8 SUM2=1.125*HT*(Y(1)+Y(2)+Y(2)+Y(2)+Y(3)+Y(3)+Y(3)+Y(4))          NASA   6984
      SUM1=Y(2)+Y(2)                                                   NASA   6985
      SUM1=SUM1+SUM1                                                   NASA   6986
      SUM1=HT*(Y(1)+SUM1+Y(3))                                         NASA   6987
      Z(1)=0.                                                          NASA   6988
      AUX1=Y(3)+Y(3)                                                   NASA   6989
      AUX1=AUX1+AUX1                                                   NASA   6990
      Z(2)=SUM2-HT*(Y(2)+AUX1+Y(4))                                    NASA   6991
      IF(NDIM-5)10,9,9                                                 NASA   6992
    9 AUX1=Y(4)+Y(4)                                                   NASA   6993
      AUX1=AUX1+AUX1                                                   NASA   6994
      Z(5)=SUM1+HT*(Y(3)+AUX1+Y(5))                                    NASA   6995
   10 Z(3)=SUM1                                                        NASA   6996
      Z(4)=SUM2                                                        NASA   6997
      RETURN                                                           NASA   6998
C                                                                      NASA   6999
C     NDIM IS EQUAL TO 3                                               NASA   7000
   11 SUM1=HT*(1.25*Y(1)+Y(2)+Y(2)-.25*Y(3))                           NASA   7001
      SUM2=Y(2)+Y(2)                                                   NASA   7002
      SUM2=SUM2+SUM2                                                   NASA   7003
```

```
      Z(3)=HT*(Y(1)+SUM2+Y(3))                                          NASA  7004
      Z(1)=0.                                                           NASA  7005
      Z(2)=SUM1                                                         NASA  7006
   12 RETURN                                                            NASA  7007
      END                                                               NASA  7008
```

```
      SUBROUTINE DPI (IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE,NOWAT)          NASA    7009
      DIMENSION IPIC(2), ICHOSE(2), NCCNF(6), NCHOSE(2)                  NASA    7010
      COMMON /USER3/ARRAYN(11,3), BTRMX,     NMSEQ,     OPSMS,    SCSFL,  022575   637
     1               TPRFL                                               022575   638
C                                                                        022575   639
      COMMON /USERI/   APOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME,   022575   640
     1                 EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT,   022575   641
     2                 EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY,   022575   642
     3         IDEBUG, ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE,   022575   643
     4          MICRO,  RELME,  SPEC(6),    SPEC1,        T,   XCGSA1,   022575   644
     5                   XMER,     XMEU                                  022575   645
C                                                                        022575   646
      COMMON /BTWN/     ACSSN,    ACSWP,      ALT,     AREA,   BATCAP,   022575   647
     1             BITRAT(2),    CLIFE,   CONVWT,        D,       DT,   022575   648
     2                    DX,       DY,       DZ,    EQBLG,   EQBSID,   022575   649
     3                    FC,       FF,   HARNWT,      HPT,   HTPIPE,   022575   650
     4                  HTPT,   HTRPRB,   HTRPWR,              IBTLOC,   022575   651
     5                 LMBDD,       NC,   OMEGS,    PASSTR,       PJ,   022575   652
     6                    PL,    PLMIN,   POCNWT,     RADA,    RADAB,   022575   653
     7                   RAT,       RJ,   SABOLG,    SATLG,   SATTWT,   022575   654
     8                 SATWT,   SATXCG,   SATYCG,   SATZCG,    SA1XL,   022575   655
     9                 SA1YL,    SA1ZL,     SIDE,   SYSLB,    THCMWT,   022575   656
     A             THRUST(2),       TI,   TNKWT,     TPRIM,       VB,   022575   657
     B                  VCHP,      VOL,     WATE,       WB,      WBT,   022575   658
     C                    WT,       XJ,   XNZERO,       YJ,       ZJ    022575   659
C                                                                        022575   660
      COMMON /DBCOM/DATAB(55,100),IDB(30)                                022575   661
C                                                                        022575   662
      COMMON /CHOSE/     COST(5,60),     ARRAY(11,60),     ICHOSG(60),   022575   663
     1                   NCHOSG(60),      REL ( 6,60),     SKD(7,60),    022575   664
     2                   THM(4,60)                                       022575   665
C                                                                        022575   666
      COMMON/PRTCOM/    ACCRCY,       AM,       AN,       BF,       BS,  022575   667
     1               COPI(7,2),   CISTAR,     CTOT,     DDTE,       DE,  022575   668
     2                   DRIWT,   EQBSTR,   FEEINV,   FEEOPS,     FEER,  022575   669
     3                     GSE,     IREL,   ITRUNC,   MMDOLD,NAME(3,60), 022575   670
     4                     OPS,   PAYINV,   PAYQUL,     PAYR,       PE,  022575   671
     5                     PMP,      PMR, PQWER(6),       PU,  PWR(60),  022575   672
     6                     QCP,      QCR, ROLD(60),   SABMWT,   SATADP,  022575   673
     7                  SATINV,     SATR,     SEIP,     SEIR, SKTAU(6),  022575   674
     8                SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7),  022575   675
     9                      TA, TAU(6,6),       TB,       TC,       TE,  022575   676
     A                      TF,    TOOLR,    TOOLU,   TOTOPS,    TRUNC,  022575   677
     B                      TS,      TTT,VOLUME(6),  VQL(60),WEIGHT(6),  022575   678
     C                   XLTOT,     XMEH,   XMEINV,     XMEL,    XMEVL,  022575   679
     D                    XMEW,    XMEWT,    XVEST                       022575   680
      DIMENSION HSRT(60),TLPTH(60),GRANH(60),XSRT(60),TLPTL(60),         022675     9
     *          GRANL(60)                                                022675    10
      DATA ACSRT,ACSOP,COMOP,OPREQ/10.,50.,6.,4./                        NASA    7027
C        INPUTS  FOR DATA PROCESSING SUBSYSTEMS - DPI                    NASA    7028
C                                                                        NASA    7029
C     INPUT  CDPI   T D SOURCE  UNITS  DESCRIPTION                       NASA    7030
C     VAR.   IN.                                                         NASA    7031
C                                                                        NASA    7032
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C     GRANH   36       R Y ALL S/S          GRANULARITY HIGH RATE TABLE          NASA      7033
C     HSRT    35       R Y ALL S/S SPS     SAMPLE RATE HIGH TABLE                NASA      7034
C     TLPTH   34+35    R Y ALL S/S         NO OF ANOL AND DIG POINTS HIGH        NASA      7035
C     GRANL   40       R Y ALL S/S         GRANULARITY LOW RATE TABLE            NASA      7036
C     XSRT    39       R Y ALL S/S SPS     SAMPLE RATE LOW TABLE                 NASA      7037
C     TLPTL   37+38    R Y ALL S/S         NO OF ANOL AND DIG POINTS LOW         NASA      7038
C     SCSFL            R    U                SPECIAL COMMAND SYNC FLAG           NASA      7039
C     TOTCM   30TO32   R   DB                TOTAL NO OF COMMANDS                NASA      7040
C     COMTY            R   MACRO             NCONF(3) - SPEC OR GEN COMPUTER FLAG NASA     7041
C     TTCPL   32       R                     TIME TAG COMMAND FLAG               NASA      7042
C     TPRFL            R   U                 TELEM PROCESS FLAG                  NASA      7043
C     ACSSN            R   SC                SUM OF ACS  SENSOR                  NASA      7044
C     COMRT            R   COMM              COMMAND RATE                        NASA      7045
C     OPSMS            R   U        SEC-1    MISSION OPS                         NASA      7046
C     MISPD            I   U                 MISSION DATA PROC. FLAG             NASA      7047
C                                                                                NASA      7048
C              ERROR FLAGS                                                       NASA      7049
C              IERR = 1      MUX IS REQUIRED                                     NASA      7050
C              IERR = 10     WORD LENGTH GREATER THAN 256                        NASA      7051
C              IERR = 100    BIT RATE IS TOO LARGE                               NASA      7052
C              IERR = 1000 SPECIAL COMMAND SYNC FLAG IS NOT EQUAL TO ZERO        NASA      7053
C              IERR = 10000   J1 .GE. J1E                                        NASA      7054
C                                                                                NASA      7055
      DO 1  I=1,7                                                                111974      67
      DO 1  J=1,2                                                                111974      68
    1 CDPI(I,J)=0.0                                                              111974      69
      IERR=0                                                                     NASA      7056
      ICHOSE(1)=0                                                                NASA      7057
      ICHOSE(2)=0                                                                NASA      7058
      IF (ITER .EQ.  0) NCHOSE(1)=1                                              NASA      7059
      IF (ITER .EQ.  0) NCHOSE(2)=1                                              NASA      7060
      BITRAT(2)=0.                                                               NASA      7061
      TOTOPS=0.                                                                  NASA      7062
      IERR1=0                                                                    NASA      7063
      IERR2=0                                                                    NASA      7064
      IERR3=0                                                                    NASA      7065
      IERR4=0                                                                    NASA      7066
      IERR5=0                                                                    NASA      7067
      NEWFL=0                                                                    NASA      7068
      IF   (NCONF(4)   .GT.   3)                                                 031775       1
     * CALL MIS(IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)                              NASA      7070
      IF   (NCONF(4)   .GT.   3)  GO TO 110                                      031775       2
      NEWFL=1                                                                    NASA      7072
  110 CONTINUE                                                                   NASA      7073
      ANOLH=0.                                                                   NASA      7074
      ANOLL=0.                                                                   NASA      7075
      MUX=0                                                                      NASA      7076
C           COMPUTE TABLES                                                       NASA      7077
      TOTCM=0                                                                    NASA      7078
      TTCFL=0                                                                    NASA      7079
      NTABH=0                                                                    NASA      7080
      NTABL=0                                                                    NASA      7081
C    ***********  WE NEED NTAB   ********************************                NASA      7082
      NTAB= NOWAT - 1                                                            NASA      7083
C    ********************************************************                   NASA      7084
      K= -1                                                                      NASA      7085
      DO 170 I=1,NTAB                                                            NASA      7086
```

```
      TOTCM=(ARRAY(K+2,I)+ARRAY(K+3,I)+ARRAY(K+4,I))*NCHOSG(I)+TOTCM     NASA    7087
      TTCFL=TTCFL+ARRAY(K+4,I)*NCHOSG(I)                                 NASA    7088
      IF (ARRAY(K+7,I).EQ.0.) GO TO 150                                  NASA    7089
      NTABH=NTABH+1                                                      NASA    7090
      HSRT(NTABH)=ARRAY(K+7,I)                                           NASA    7091
      GRANH(NTABH)=ARRAY(K+8,I)                                          NASA    7092
      TLPTH(NTABH)=(ARRAY(K+5,I)+ARRAY(K+6,I))*NCHOSG(I)                 NASA    7093
  150 IF (ARRAY(K+6,I).NE.0.) MUX=1                                      NASA    7094
      IF (ARRAY(K+11,I).EQ.0.) GO TO 160                                 NASA    7095
      NTABL=NTABL+1                                                      NASA    7096
      XSRT(NTABL)=ARRAY(K+11,I)                                          NASA    7097
      GRANL(NTABL)=ARRAY(K+12,I)                                         NASA    7098
      TLPTL(NTABL)=(ARRAY(K+9,I)+ARRAY(K+10,I))*NCHOSG(I)                NASA    7099
  160 IF (ARRAY(K+10,I).NE.0.) MUX=1                                     NASA    7100
      ANOLH=ANOLH+ARRAY(K+5,I)*NCHOSG(I)                                 NASA    7101
  170 ANOLL=ANOLL+ARRAY(K+9,I)*NCHOSG(I)                                 NASA    7102
      IF (NEWFL.EQ.0) GO TO 240                                          NASA    7103
C    **********  WE NEED NTABN  ********************************         NASA    7104
      NTABN= NMSEQ                                                       NASA    7105
C    *******************************************************************  NASA    7106
      K= -1                                                              NASA    7107
      DO 230 I=1,NTABN                                                   NASA    7108
      TOTCM=TOTCM+ARRAYN(K+2,I)+ARRAYN(K+3,I)+ARRAYN(K+4,I)              NASA    7109
      TTCFL=TTCFL+ARRAYN(K+4,I)                                          NASA    7110
      IF (ARRAYN(K+7,I).EQ.0.) GO TO 210                                 NASA    7111
      NTABH=NTABH+1                                                      NASA    7112
      HSRT(NTABH)=ARRAYN(K+7,I)                                          NASA    7113
      GRANH(NTABH)=ARRAYN(K+8,I)                                         NASA    7114
      TLPTH(NTABH)=ARRAYN(K+5,I)+ARRAYN(K+6,I)                           NASA    7115
  210 IF (ARRAYN(K+6,I).NE.0.) MUX=1                                     NASA    7116
      IF (ARRAYN(K+11,I).EQ.0.) GO TO 220                                NASA    7117
      NTABL=NTABL+1                                                      NASA    7118
      XSRT(NTABL)=ARRAYN(K+11,I)                                         NASA    7119
      GRANL(NTABL)=ARRAYN(K+12,I)                                        NASA    7120
      TLPTL(NTABL)=ARRAYN(K+9,I)+ARRAYN(K+10,I)                          NASA    7121
  220 IF (ARRAYN(K+10,I).NE.0.) MUX=1                                    NASA    7122
      ANOLH=ANOLH+ARRAYN(K+5,I)                                          NASA    7123
  230 ANOLL=ANOLL+ARRAYN(K+9,I)                                          NASA    7124
  240 CONTINUE                                                           NASA    7125
C         ANOLH--NO OF ANOL PTS IN HIGH  TAB                             NASA    7126
C         ANOLL -NO OF ANOL PTS IN LOW   TAB                             NASA    7127
      IF (MUX.NE.0) IERR1=1                                              NASA    7128
      IERR=IERR+IERR1                                                    NASA    7129
C     COUNT NUMBER OF POINTS OF ALL TABLES                               NASA    7130
      SUMTLP=0.                                                          NASA    7131
      JL=0                                                               NASA    7132
      BTRFL=0                                                            NASA    7133
      IF (BTRMX.NE.1.024E6) BTRFL=1                                      NASA    7134
C         ORDER TELEM POINTS BY SAMPLE RATE - HIGH                       NASA    7135
      IF (NTABH.EQ.1) GO TO 280                                          NASA    7136
  250 CONTINUE                                                           NASA    7137
      CALL ORDER (NTABH,HSRT,TLPTH,GRANH,XM2,MEDIAN)                     NASA    7138
      JL=JL+1                                                            NASA    7139
      IF (JL.EQ.2) GO TO 280                                             NASA    7140
      DO 270 I=1,MEDIAN                                                  NASA    7141
  260 IF (HSRT(I).LE.XM2) GO TO 270                                      NASA    7142
      HSRT(I)=HSRT(I)/2.                                                 NASA    7143
```

```
           TLPTH(I)=2.*TLPTH(I)                                  NASA      7144
           GO TO 260                                             NASA      7145
     270   CONTINUE                                              NASA      7146
           GO TO 25C                                             NASA      7147
     280   SSR=HSRT(1)                                           NASA      7148
     C         SSR = MAIN FRAME RATE                             NASA      7149
           JL=0                                                  NASA      7150
           IF (NTABH.EQ.1) GO TO 320                             NASA      7151
     290   CONTINUE                                              NASA      7152
           CALL ORDER (NTABH,GRANH,TLPTH,FSRT,XM2,MEDIAN)        NASA      7153
           JL=JL+1                                               NASA      7154
           IF (JL.EQ.2) GO TO 320                                NASA      7155
           DO 310 I=1,MEDIAN                                     NASA      7156
     300   IF (GRANH(I).LE.XM2) GO TO 310                        NASA      7157
           GRANH(I)=GRANH(I)/2.                                  NASA      7158
           TLPTH(I)=2.*TLPTH(I)                                  NASA      7159
           GO TO 300                                             NASA      7160
     310   CONTINUE                                              NASA      7161
           GO TO 290                                             NASA      7162
     320   SUMWH=0                                               NASA      7163
           DO 330 I=1,NTABH                                      NASA      7164
     330   SUMWH=SUMWH+TLPTH(I)                                  NASA      7165
     C     SUMWH = NUMBER OF WORDS                               NASA      7166
           SUMWH=SUMWH*1.2                                       NASA      7167
           IF (SUMWH.LE.256.) GO TO 340                          NASA      7168
           ICHOSE(1)=-1                                          NASA      7169
           IERR2=10                                              NASA      7170
           IERR=IERR+IERR2                                       NASA      7171
           RETURN                                                NASA      7172
     340   POWER=16.                                             NASA      7173
           DO 350 NN=5,8                                         NASA      7174
           N=NN                                                  NASA      7175
           POWER=POWER*2.                                        NASA      7176
           IF (POWER.GE.SUMWH) GO TO 360                         NASA      7177
     350   CONTINUE                                              NASA      7178
     360   TLMWD=POWER                                           NASA      7179
     C         MAIN FRAME LENGTH    - TLMWD                      NASA      7180
     C         WDLMAX = WORD LENGTH TO MAX REQUIRED LENGTH       NASA      7181
           WDLMAX=0.                                             NASA      7182
           DO 365 II=1,NTABH                                     NASA      7183
           IF (GRANH(II) .GT. WDLMAX) WDLMAX=GRANH(II)           NASA      7184
       365 CONTINUE                                              NASA      7185
           CDPI(2,1) = TLMWD                                     111874      75
           CDPI(3,1) = SSR                                       111874      76
           CDPI(4,1) = WDLMAX                                    111874      77
           BIRATE=WDLMAX*TLMWD*SSR                               NASA      7186
           PRINT 1000,BIRATE                                     110474       1
      1000 FORMAT (13H BIRATE (1) = ,E11.4)                      110474       2
           DO 370 MM=1,18                                        NASA      7187
           N=MM-1                                                NASA      7188
           TT=2.**N*7.8125                                       NASA      7189
           IF (TT.GE.BIRATE) GO TO 380                           NASA      7190
     370   CONTINUE                                              NASA      7191
           ICHOSE(1)=-1                                          NASA      7192
           IERR3=100                                             NASA      7193
           IERR=IERR+IERR3                                       NASA      7194
     C         IERR = 100   BIT RATE TOO LARGE                   NASA      7195
```

```
            RETURN                                                      NASA    7196
      380   BIRATE=TT                                                   NASA    7197
            BITRAT(1)=BIRATE                                            NASA    7198
            JL=0                                                        NASA    7199
      C     ORDER LOW SAMPLE RATE                                       NASA    7200
            IF (NTABL.EQ.1) GO TO 420                                   NASA    7201
      390   CONTINUE                                                    NASA    7202
            CALL ORDER (NTABL,XSRT,TLPTL,GRANL,XM2,MEDIAN)              NASA    7203
            JL=JL+1                                                     NASA    7204
            IF (JL.EQ.2) GO TO 420                                      NASA    7205
            DO 410 I=1,MEDIAN                                           NASA    7206
      400   IF (XSRT(I).LE.XM2) GO TO 410                               NASA    7207
            XSRT(I)=XSRT(I)/2.                                          NASA    7208
            TLPTL(I)=TLPTL(I)*2.                                        NASA    7209
            GO TO 400                                                   NASA    7210
      410   CONTINUE                                                    NASA    7211
            GO TO 390                                                   NASA    7212
      420   SFR=XSRT(1)                                                 NASA    7213
      C         SFR = HIGHEST RATE IN LOW RATE TABLE                    NASA    7214
            SFL=SSR/SFR                                                 NASA    7215
      C     SFL  SUB FRAME LENGTH                                       NASA    7216
            N=5                                                         NASA    7217
            IF (SFL.LE.2.**N) GO TO 440                                 NASA    7218
            N=7                                                         NASA    7219
            IF (SFL.GE.2.**N) GO TO 440                                 NASA    7220
            CO 430 N=5,7                                                NASA    7221
            NP1=N+1                                                     NASA    7222
            IF (SFL.GE.2.**N.AND.SFL.LE.2.**NP1) GO TO 440              NASA    7223
      430   CONTINUE                                                    NASA    7224
      440   SFL=2.**N                                                   NASA    7225
            SUMWL=0.                                                    NASA    7226
            DO 450 I=1,NTABL                                            NASA    7227
      450   SUMWL=SUMWL+TLPTL(I)                                        NASA    7228
            SUMWL=SUMWL*1.2                                             NASA    7229
            NSUBFR=SUMWL/SFL+1                                          NASA    7230
      C     (1) BIT RATE                            TT                  NASA    7231
      C     (2) WORD LENGTH                         WDLMAX              NASA    7232
      C     (3) NUMBER OF M/F WORDS                 TLMWD               NASA    7233
      C     (4) NUMBER OF SUBFRAMES                 NSUBFR              NASA    7234
      C     (5) NUMBER OF WORDS PER S/F             SFL                 NASA    7235
      C     (6) NEED FOR DIGITAL MUX                MUX                 NASA    7236
            CDPI(5,1) = NSUBFR                                          111874    78
            CDPI(6,1) = SFR                                             111874    79
            CDPI(7,1) = SFL                                             111874    80
      C                                                                 NASA    7237
      C         SPECIAL COMMAND SYNC FLAG                               NASA    7238
            IF (SCSFL.NE.0.) IERR4=1000                                 NASA    7239
            IERR=IERR+IERR4                                             NASA    7240
            TOTCM=TOTCM*1.5                                             NASA    7241
            CO 460 NN=1,100                                             NASA    7242
            N=NN                                                        NASA    7243
            IF (TOTCM.LE.2.**N) GO TO 470                               NASA    7244
      460   CONTINUE                                                    NASA    7245
      470   TOTCM=2.**N                                                 NASA    7246
            CDPI(1,1) = TOTCM                                           111874    81
            COWDLN=N                                                    NASA    7247
            M=NCONF(3)                                                  NASA    7248
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      GO TO (480,500), M                                              NASA      7249
  480 TLMOPS=0                                                        NASA      7250
      IF (TPRFL.NE.0.) TLMOPS=TT*OPREQ/WDLMAX                         NASA      7251
      IF (TPRFL.NE.0.) GO TO 490                                      NASA      7252
      J1=IDB(1)+1                                                     NASA      7253
      IPIC(2)=J1                                                      NASA      7254
      ICHOSE(2)=DATAB(1,J1)                                           NASA      7255
      IF(ITER.EQ.0) NCHOSE(2)= 1                                      NASA      7256
      WT= WT + NCHOSE(2)*DATAB(23,J1)                                 NASA      7257
      VOL= VOL + NCHOSE(2)*DATAB(24,J1)                               NASA      7258
      PL= PL + NCHOSE(2)*DATAB(16,J1)                                 NASA      7259
      PLMIN= PLMIN + NCHOSE(2)*DATAB(18,J1)                           NASA      7260
  490 CONTINUE                                                        NASA      7261
      ACSOPS=ACSSN*ACSRT*ACSOP                                        NASA      7262
      CMDOPS = COMRAT * COMOP                                         022675      11
      TOTOPS=TLMOPS+ACSOPS+CMDOPS+OPSMS                               NASA      7264
      TOTOPS=TOTOPS*1.2*1.5                                           NASA      7265
  500 IF (ITER.NE.0) GO TO 510                                        NASA      7266
      IERR=0                                                          NASA      7267
      NEQUIP=2                                                        NASA      7268
      ICHOSE(1)=0                                                     NASA      7269
  510 L=1                                                             NASA      7270
      J1E=IDB(M)                                                      NASA      7271
      J1 = 1                                                          012875       3
      IF (M .NE. 1) J1 = IDB(1) + 1                                   012875       4
      IF (IPIC(L).NE.0) GO TO 520                                     NASA      7272
      GO TO 540                                                       NASA      7275
  520 IF (ITER.EQ.0) GO TO 530                                        NASA      7276
      J1=IPIC(L)                                                      NASA      7277
      GO TO 540                                                       NASA      7278
  530 IF (IPIC(L) .GE. J1E) GO TO 570                                 012875       5
      J1=IPIC(L)+1                                                    NASA      7280
  540 HARPAR=DATAB(6,J1)*1000.                                        NASA      7281
      GO TO (560,550), M                                              NASA      7282
  550 IPIC(L)=J1                                                      NASA      7283
      ICHOSE(L)=DATAB(1,J1)                                           NASA      7284
      IF(ITER.EQ.0) NCHOSE(L)=1                                       NASA      7285
      WT= WT + NCHOSE(L)*DATAB(23,J1)                                 NASA      7286
      VOL= VOL + NCHOSE(L)*DATAB(24,J1)                               NASA      7287
      PL= PL + NCHOSE(L)*DATAB(16,J1)                                 NASA      7288
      PLMIN= PLMIN + NCHOSE(L)*DATAB(18,J1)                           NASA      7289
      RETURN                                                          NASA      7290
  560 HARPAR=DATAB(6,J1)*1000.                                        NASA      7291
      IF (TOTOPS.LE.HARPAR) GO TO 550                                 NASA      7292
      IF (J1.GE.J1E) GO TO 570                                        NASA      7293
      J1=J1+1                                                         NASA      7294
      GO TO 560                                                       NASA      7295
  570 IERR5=10000                                                     NASA      7296
      IERR=IERR+IERR5                                                 NASA      7297
      ICHOSE(L)=-1                                                    NASA      7298
      RETURN                                                          NASA      7299
      END                                                             NASA      7300

REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 189
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 257
```

```
      SUBROUTINE ORDER (N,A,B,C,XM2,MEDIAN)                             NASA 7301
C     ORDERS ARRAYS AND GETS MEDIAN VALUES                              NASA 7302
      DIMENSION A(1), B(1), C(1)                                        NASA 7303
      IF (N .EQ. 1) GO TO 50                                            NASA 7304
      MEDIAN=N/2                                                        NASA 7305
      KK=MEDIAN*2                                                       NASA 7306
      KKK=2                                                             NASA 7307
      IF (KK.NE.N) KKK=1                                                NASA 7308
C     KKK = 1 , ODD NUMBER OF POINTS                                    NASA 7309
      DO 20 I=1,N                                                       NASA 7310
      IF (A(I).EQ.0.) GO TO 20                                          NASA 7311
      XLG=A(I)                                                          NASA 7312
      JJ=I                                                              NASA 7313
      DO 10 J=I,N                                                       NASA 7314
      IF (XLG.GE.A(J)) GO TO 10                                         NASA 7315
      XLG=A(J)                                                          NASA 7316
      JJ=J                                                              NASA 7317
   10 CONTINUE                                                          NASA 7318
      IF (I.EQ.JJ) GO TO 20                                             NASA 7319
      AS=A(I)                                                           NASA 7320
      BS=B(I)                                                           NASA 7321
      CS=C(I)                                                           NASA 7322
      A(I)=A(JJ)                                                        NASA 7323
      B(I)=B(JJ)                                                        NASA 7324
      C(I)=C(JJ)                                                        NASA 7325
      A(JJ)=AS                                                          NASA 7326
      B(JJ)=BS                                                          NASA 7327
      C(JJ)=CS                                                          NASA 7328
   20 CONTINUE                                                          NASA 7329
      GO TO (30,40), KKK                                                NASA 7330
   30 XM2=A(MEDIAN)*2.                                                  NASA 7331
      RETURN                                                            NASA 7332
   40 XM2=A(MEDIAN)+A(MEDIAN+1)                                         NASA 7333
      RETURN                                                            NASA 7334
   50 CONTINUE                                                          NASA 7335
      XM2=2.*A(1)                                                       NASA 7336
      MEDIAN=1                                                          NASA 7337
      RETURN                                                            NASA 7338
      END                                                               NASA 7339
```

```
      SUBROUTINE MIS (IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)                  NASA      7340
      DIMENSION IPIC(2), ICHOSE(2), NCONF(6), NCHOSE(2)                     NASA      7341
      COMMON /USER3/ARRAYN(11,3), BTRMX,    NMSEQ,    OPSMS,    SCSFL,     022575     681
     1              TPRFL                                                  022575     682
C                                                                          022575     683
      COMMON /BTNN/        ACSSN,    ACSWP,     ALT,      AREA,   BATCAP,  022575     684
     1              BITRAT(2),    CLIFE,   CONVWT,        D,       DT,     022575     685
     2                     DX,       DY,       DZ,     EQBLG,   EQBSID,    022575     686
     3                     FC,       FF,   HARNWT,       HPT,   HTPIPE,    022575     687
     4                   HTPT,   HTRPRB,   HTRPWR,             IBTLOC,     022575     688
     5                  LMBOD,       NC,    OMEGS,    PASSTR,       PJ,    022575     689
     6                     PL,    PLMIN,   POCNWT,      RADA,   RADAB,     022575     690
     7                    RAT,       RJ,   SABOLG,     SATLG,   SATTWT,    022575     691
     8                  SATWT,   SATXCG,   SATYCG,    SATZCG,   SA1XL,     022575     692
     9                  SA1YL,    SA1ZL,     SIDE,     SYSLB,   THCMWT,    022575     693
     A              THRUST(2),       TI,    TNKWT,     TPRIM,       VB,    022575     694
     B                   VCHP,      VOL,     WATE,        WB,      WBT,    022575     695
     C                     WT,       XJ,   XNZERO,        YJ,       ZJ     022575     696
C                                                                          022575     697
      COMMON /DBCOM/DATAB(55,100),IDB(30)                                  022575     698
C                                                                          022575     699
      COMMON /CHOSE/       COST(5,60),    ARRAY(11,60),    ICHOSG(60),     022575     700
     1                     NCHOSG(60),    REL  ( 6,60),    SKD(7,60),      022575     701
     2                     THM(4,60)                                       022575     702
C                                                                          022575     703
      COMMON/PRTCOM/      ACCRCY,       AM,       AN,        BF,       BS, 022575     704
     1              CDPI(7,2),   CISTAR,     CTOT,      DDTE,       DE,    022575     705
     2                  DRIWT,   EQBSTR,   FEEINV,    FEEOPS,     FEER,    022575     706
     3                    GSE,     IREL,   ITRUNC,    HMDOLD,NAME(3,60),   022575     707
     4                    OPS,   PAYINV,   PAYQUL,      PAYR,       PE,    022575     708
     5                    PMP,      PWR, POWER(6),        PU,  PWR(60),    022575     709
     6                    QCP,      QCR, ROLD(60),    SABMWT,   SATADP,    022575     710
     7                 SATINV,     SATR,     SEIP,      SEIR, SKTAU(6),    022575     711
     8               SSREL(6),  SUBE(7),  SUBT(7),  SUBUE(7), SUBUP(7),    022575     712
     9                     TA, TAU(6,6),       TB,        TC,       TE,    022575     713
     A                     TF,    TOOLR,    TOOLU,    TOTOPS,    TRUNC,    022575     714
     B                     TS,      TTT,VOLUME(6),   VOL(60),WEIGHT(6),    022575     715
     C                  XLTOT,     XMEH,   XMEINV,      XMEL,    XMEVL,    022575     716
     D                   XMEW,    XMEWT,    XVEST                          022575     717
      DIMENSION HSRT(60),TLPTH(60),GRANH(60),XSRT(60),TLPTL(60),           022675      12
     *        GRANL(60)                                                    022675      13
C           INPUTS  FOR DATA PROCESSING SUBSYSTEMS - MIS                   NASA      7353
C                                                                          NASA      7354
C     INPUT   CDPI     T D SOURCE  UNITS  DESCRIPTION                      NASA      7355
C     VAR.    IN.                                                          NASA      7356
C                                                                          NASA      7357
C     GRANH   36       R Y ALL S/S         GRANULARITY HIGH RATE TABLE     NASA      7358
C     HSRT    35       R Y ALL S/S  SPS    SAMPLE RATE HIGH TABLE          NASA      7359
C     TLPTH   34+35    R Y ALL S/S         NO OF ANOL AND DIG POINTS HIGH  NASA      7360
C     GRANL   40       R Y ALL S/S         GRANULARITY LOW RATE TABLE      NASA      7361
C     XSRT    39       R Y ALL S/S  SPS    SAMPLE RATE LOW TABLE           NASA      7362
C     TLPTL   37+38    R Y ALL S/S         NO OF ANOL AND DIG POINTS LOW   NASA      7363
C     SCSFL            R    U              SPECIAL COMMAND SYNC FLAG       NASA      7364
C     TOTCM   30TO32   R    DB             TOTAL NO OF COMMANDS            NASA      7365
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C  COMTY        R   MACRO            NCONF(3) - SPEC OR GEN COMPUTER FLAG NASA      7366
C  TTCPL   32   R                    TIME TAG COMMAND FLAG                NASA      7367
C  TPRFL        R   U                TELEM PROCESS FLAG                   NASA      7368
C  ACSSN        R   SC               SUM OF ACS  SENSOR                   NASA      7369
C  COMRT        R   COMM             COMMAND RATE                         NASA      7370
C  OPSMS        R   U       SEC-1    MISSION OPS                          NASA      7371
C  MISPD        I   U                MISSION DATA PROC. FLAG              NASA      7372
C                                                                         NASA      7373
C          ERROR FLAGS                                                    NASA      7374
C          IERR = 1     MUX IS REQUIRED                                   NASA      7375
C          IERR = 10    WORD LENGTH GREATER THAN 256                      NASA      7376
C          IERR = 100   BIT RATE IS TOO LARGE                             NASA      7377
C          IERR = 1000 SPECIAL COMMAND SYNC FLAG IS NOT EQUAL TO ZERO     NASA      7378
C       IERR = 10000  J1 .GE. J1E                                         NASA      7379
C                                                                         NASA      7380
      IERR=0                                                              NASA      7381
      IERR1=0                                                             NASA      7382
      IERR2=0                                                             NASA      7383
         IERR3=0                                                          NASA      7384
         IERR4=0                                                          NASA      7385
         IERR5=0                                                          NASA      7386
         ANOLH=0.                                                         NASA      7387
         ANOLL=0.                                                         NASA      7388
      MUX=0                                                               NASA      7389
C        COMPUTE TABLES                                                   NASA      7390
      TOTCM=0                                                             NASA      7391
      TTCFL=0                                                             NASA      7392
      NTABH=0                                                             NASA      7393
         NTABL=0                                                          NASA      7394
C   ***********  WE NEED NTABN  ********************************           NASA      7395
      NTABN= NMSEQ                                                        NASA      7396
C   ****************************************************************      NASA      7397
      K= -1                                                               NASA      7398
      DO 60  I=1,NTABN                                                    NASA      7399
      TOTCM=TOTCM+ARRAYN(K+2,I)+ARRAYN(K+3,I)+ARRAYN(K+4,I)               NASA      7400
      TTCFL=TTCFL+ARRAYN(K+4,I)                                           NASA      7401
      IF (ARRAYN(K+7,I).EQ.0.) GO TO 40                                   NASA      7402
      NTABH=NTABH+1                                                       NASA      7403
      HSRT(NTABH)=ARRAYN(K+7,I)                                           NASA      7404
      GRANH(NTABH)=ARRAYN(K+8,I)                                          NASA      7405
      TLPTH(NTABH)=ARRAYN(K+5,I)+ARRAYN(K+6,I)                            NASA      7406
 40   IF (ARRAYN(K+6,I).NE.0.) MUX=1                                      NASA      7407
      IF (ARRAYN(K+11,I).EQ.0.) GO TO 50                                  NASA      7408
      NTABL=NTABL+1                                                       NASA      7409
      XSRT(NTABL)=ARRAYN(K+11,I)                                          NASA      7410
      GRANL(NTABL)=ARRAYN(K+12,I)                                         NASA      7411
      TLPTL(NTABL)=ARRAYN(K+9,I)+ARRAYN(K+10,I)                           NASA      7412
 50   IF (ARRAYN(K+10,I).NE.0.) MUX=1                                     NASA      7413
      ANOLH=ANOLH+ARRAYN(K+5,I)                                           NASA      7414
 60   ANOLL=ANOLL+ARRAYN(K+9,I)                                           NASA      7415
C          ANOLH--NO OF ANCL PTS IN HIGH  TAB                             NASA      7416
C          ANOLL -NO OF ANOL PTS IN LOW   TAB                             NASA      7417
      IF (MUX.NE.0) IERR1=1                                               NASA      7418
      IERR=IERR+IERR1                                                     NASA      7419
C     COUNT NUMBER OF POINTS OF ALL TABLES                                NASA      7420
      SUMTLP=0.                                                           NASA      7421
      JL=0                                                                NASA      7422
```

```
      BTRFL=0
      IF (BTRMX.NE.1.024E6) BTRFL=1
C          ORCER TELEM POINTS BY SAMPLE RATE - HIGH
      IF (NTABH.EQ.1) GO TO 100
70    CONTINUE
      CALL ORDER (NTABH,HSRT,TLPTH,GRANH,XM2,MEDIAN)
      JL=JL+1
      IF (JL.EQ.2) GO TO 100
      DO 90 I=1,MEDIAN
80    IF (HSRT(I).LE.XM2) GO TO 90
      HSRT(I)=HSRT(I)/2.
      TLPTH(I)=2.*TLPTH(I)
      GO TO 80
90    CONTINUE
      GO TO 70
100   SSR=HSRT(1)
C          SSR = MAIN FRAME RATE
      IF (NTABH.EQ.1) GO TO 140
      JL=0
110   CONTINUE
      CALL ORDER (NTABH,GRANH,TLPTH,HSRT,XM2,MEDIAN)
      JL=JL+1
      IF (JL.EQ.2) GO TO 140
      DO 130 I=1,MEDIAN
120   IF (GRANH(I).LE.XM2) GO TO 130
      GRANH(I)=GRANH(I)/2.
      TLPTH(I)=2.*TLPTH(I)
      GO TO 120
130   CONTINUE
      GO TO 110
140   SUMWH=0
      DO 150 I=1,NTABH
150   SUMWH=SUMWH+TLPTH(I)
C     SUMWH = NUMBER OF WORDS
      SUMWH=SUMWH*1.2
      IF (SUMWH.LE.256.) GO TO 160
      ICHOSE(1)=-1
      IERR2=10
      IERR=IERR+IERR2
      RETURN
160   POWER=16.
      DO 170 NN=5,8
      N=NN
      POWER=POWER*2.
      IF (POWER.GE.SUMWH) GO TO 180
170   CONTINUE
180   TLMWD=POWER
C          MAIN FRAME LENGTH    - TLMWD
C          WDLMAX = WORD LENGTH TO MAX REQUIRED LENGTH
      WDLMAX=0.
      CO 185 II=1,NTABH
      IF (GRANH(II) .GT. WDLMAX) WDLMAX=GRANH(II)
  185 CONTINUE
      CDPI(1,2) = TOTCM
      CDPI(2,2) = TLMWD
      CDPI(3,2) = SSR
      CDPI(4,2) = WDLMAX
```

```
      BIRATE=WDLMAX*TLMWD*SSR                                           NASA      7476
      PRINT 1000,BIRATE                                                 110474       3
 1000 FORMAT (13H BIRATE (2) = ,E11.4)                                  110474       4
      DO 190 MM=1,18                                                    NASA      7477
      N=MM-1                                                            NASA      7478
      TT=2.**N*7.8125                                                   NASA      7479
      IF (TT.GE.BIRATE) GO TO 200                                       NASA      7480
  190 CONTINUE                                                          NASA      7481
      ICHOSE(1)=-1                                                      NASA      7482
      IERR3=100                                                         NASA      7483
      IERR=IERR+IERR3                                                   NASA      7484
C           IERR = 100    BIT RATE TOO LARGE                            NASA      7485
      RETURN                                                            NASA      7486
  200 BIRATE=TT                                                         NASA      7487
      BITRAT(2)=BIRATE                                                  NASA      7488
      IF (NTABL.EQ.1) GO TO 240                                         NASA      7489
      JL=0                                                              NASA      7490
C     ORDER LOW SAMPLE RATE                                             NASA      7491
  210 CONTINUE                                                          NASA      7492
      CALL ORDER (NTABL,XSRT,TLFTL,GRANL,XM2,MEDIAN)                    NASA      7493
      JL=JL+1                                                           NASA      7494
      IF (JL.EQ.2) GO TO 240                                            NASA      7495
      DO 230 I=1,MEDIAN                                                 NASA      7496
  220 IF (XSRT(I).LE.XM2) GO TO 230                                     NASA      7497
      XSRT(I)=XSRT(I)/2.                                                NASA      7498
      TLPTL(I)=TLPTL(I)*2.                                              NASA      7499
      GO TO 220                                                         NASA      7500
  230 CONTINUE                                                          NASA      7501
      GO TO 210                                                         NASA      7502
  240 SFR=XSRT(1)                                                       NASA      7503
C          SFR = HIGHEST RATE IN LOW RATE TABLE                         NASA      7504
      SFL=SSR/SFR                                                       NASA      7505
C     SFL   SUB FRAME LENGTH                                            NASA      7506
      N=5                                                               NASA      7507
      IF (SFL.LE.2.**N) GO TO 260                                       NASA      7508
      N=7                                                               NASA      7509
      IF (SFL.GE.2.**N) GO TO 260                                       NASA      7510
      DO 250 N=5,7                                                      NASA      7511
      NP1=N+1                                                           NASA      7512
      IF (SFL.GE.2.**N.AND.SFL.LE.2.**NP1) GO TO 260                    NASA      7513
  250 CONTINUE                                                          NASA      7514
  260 SFL=2.**N                                                         NASA      7515
      SUMWL=0.                                                          NASA      7516
      DO 270 I=1,NTABL                                                  NASA      7517
  270 SUMWL=SUMWL+TLFTL(I)                                              NASA      7518
      SUMWL=SUMWL*1.2                                                   NASA      7519
      NSUBFR=SUMWL/SFL+1                                                NASA      7520
C     (1) BIT RATE                           TT                         NASA      7521
C     (2) WORD LENGTH                        WDLMAX                     NASA      7522
C     (3) NUMBER OF M/F WORDS                TLMWD                      NASA      7523
C     (4) NUMBER OF SUBFRAMES                NSUBFR                     NASA      7524
C     (5) NUMBER OF WORDS PER S/F            SFL                        NASA      7525
C     (6) NEED FOR DIGITAL MUX               MUX                        NASA      7526
      CDPI(5,2) = NSUBFR                                                111874      87
      CDPI(6,2) = SFR                                                   111874      88
      CDPI(7,2) = SFL                                                   111874      89
      IF  (NCONF(3)  .EQ.  1) GO TO 280                                 031775       3
```

```
                                                                        NASA      7527
      C                                                                 NASA      7528
            J1=IDB(1)+1                                                 NASA      7529
            IPIC(2)=J1                                                  NASA      7530
            ICHOSE(2)=DATAB(1,J1)                                       NASA      7531
            IF(ITER.EQ.0) NCHOSE(2)=1                                   NASA      7532
            WT= WT + NCHOSE(2)*DATAB(23,J1)                             NASA      7533
            VOL= VOL + NCHOSE(2)*DATAB(24,J1)                           NASA      7534
            PL= PL + NCHOSE(2)*DATAB(16,J1)                             NASA      7535
            PLMIN= PLMIN + NCHOSE(2)*DATAB(18,J1)                       031775       4
        280 CONTINUE                                                    NASA      7536
            RETURN                                                      NASA      7537
            END

REGISTER ALLOCATION
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 143
1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE 212
```

10. DETAILED FLOW CHARTS

The following are detailed flow charts of the entire model.

C-4

```
*DECK NASA
C       THIS IS THE MAIN DRIVER
C       IT SEQUENCES ALL SEGMENTS OF CODING,HANDLES I/O,SETS
C       CONFIGURATIONS
C   ******************************************************************
```

```
PROGRAM NASACP (INPUT,OUTPUT,TAPE1,TAPE5=INPUT,TAPE6=OUTPUT)
```

```
COMMON /USER1/     ALPHA,      AX,       AY,       AZ,      DPHI,
                      EA,    EANT,      EPI,        K,      MANV,
                   OMEGR,  PDOTAV,   PDOTRX,   PDOTRY,    PDOTRZ,
                  PDOTST,   PDOTX,    PDOTY,    PDOTZ,     PDOTO,
                  PHIFOV,   PHIRX,    PHIRY,    PHIRZ,    TACCEL,
                  THETMX,   THOLD,       TL,    TPMIN,    TSMALL,
                      XN,     XNN,     XNNN,      XNU,        YN,
                      ZN
```

```
COMMON /USER3/ARRAYN(11,3), BTRMX,    NMSEQ,    OPSMS,     SCSFL,
                   TPRFL
```

```
COMMON /USER4/BWIDTH(2),  FREQ(2),     FREQR,IOPTCM(3),     LINK,
                   NADIR,     NET
```

```
COMMON /USER6/ CGEEX(9), EELOC(9), EEQVL(9),   EM1YCG,    EM1ZCG,
          EQPF,   EM2YCG,   EM2ZCG,   ISBOFG,   NUMEEQ,    XCGSA3
```

```
COMMON /USER8/SKDME(7,3)
COMMON /USER9/        CA,      CE
COMMON /USERR/      ISPT,    ISUB,    KEOPT,   RFIXED,     SLBMX
COMMON /USERC/    FEEPCT,  IMETYP,      NFV,      NQV,        PI
COMMON /USERP/    IPRINT,  ITITLE
```

```
COMMON /USERI/    APOGEE,  COMRAT,   DIAMAX, EEQWT(9),      EPME,
                  EQM1WT,  EQM1XL,   EQM1YL,   EQM1ZL,    EQM2WT,
                  EQM2XL,  EQM2YL,   EQM2ZL,       FE,    IAGNCY,
        IDEBUG,   ISATOR,  MB12SH,   OPTEMP,   ORBINC,    PERIGE,
         MICRO,    RELME, SPEC(6),    SPEC1,        T,    XCGSA1,
                    XMER,    XMEU
```

```
COMMON /BTWN/      ACSSN,   ACSWP,      ALT,     AREA,    BATCAP,
               BITRAT(2),   CLIFE,   CONVWT,        D,        DT,
                      DX,      DY,       DZ,    EQBLG,    EQBSID,
                      FC,      FF,   HARNWT,      HPT,    HTPIPE,
                    HTPT,  HTRPRB,   HTRPWR,              IBTLOC,
                   LMBOD,      NC,    OMEGS,   PASSTR,        PJ,
                      PL,   PLMIN,   POCNWT,     RADA,     RADAB,
                     RAT,      RJ,   SABOLG,    SATLG,    SATTWT,
```

```
                   SATWT,  SATXCG,   SATYCG,   SATZCG,    SA1XL,
                   SA1YL,   SA1ZL,     SIDE,    SYSLB,    THCMWT,
               THRUST(2),      TI,    TNKWT,    TPRIM,        VB,
                    VCHP,     VOL,     WATE,       WB,       WBT,
                      WT,      XJ,   XNZERO,       YJ,        ZJ
```

CONT. ON PG 2

```
COMMON /DBCOM/DATAB(55,100),IDB(30)
```

```
COMMON /CHOSE/     COST(5,60),      DPIA(11,60),     ICHOSE(60),
                   NCHOSE(60),      REL ( 6,60),     SKD(7,60),
                   THM(4,60)
```

```
COMMON/PRTCOM/   ACCRCY,        AM,         AN,         BF,        BS,
             COPI(7,2),    CISTAR,       CTOT,       DDTE,        DE,
                DRIWT,     EQBSTR,     FEEINV,     FEEOPS,       FEER,
                  GSE,       IREL,     ITRUNC,     MMDOLD,NAME(3,60),
                  OPS,     PAYINV,     PAYQUL,       PAYR,         PE,
                  PMP,        PMR,   POWER(6),         PU,    PWR(60),
                  QCP,        QCR,   ROLD(60),     SABMWT,     SATADP,
               SATINV,       SATR,       SEIP,       SEIR,  SKTAU(6),
```

```
             SSREL(6),    SUBE(7),    SUBT(7),  SUBUE(7),  SUBUP(7),
                   TA,  TAU(6,6),         TB,        TC,         TE,
                   TF,     TOOLR,      TOOLU,    TOTOPS,      TRUNC,
                   TS,      TTT,VOLUME(6),    VOL(60),WEIGHT(6),
                XLTOT,      XMEW,     XMEINV,      XMEL,      XMEVL,
                 XMEW,     XMEWT,      XVEST
```

```
DIMENSION NCONF(6),NEQUIP(5),IERR(7),IPIC1(3),IPIC2(9),IPIC3(2),
 IPIC4(9),IPIC5(5),ICHOS1(9),ICHOS2(14),ICHOS3(2),ICHOS4(11),
ICHOS5(5),NCHOS1(9),NCHOS2(14),NCHOS3(2),NCHOS4(11),NCHOS5(5)
```

```
DIMENSION ITITLE(13)
```

```
C ******************************************************************
C **       THE NAMELIST INPUTS ARE BROKEN INTO THREE CATEGORIES. THAT **
C **   IS CATEGORIES OF REQUIRED, DESIRED, AND OPTIONAL PARAMETERS.   **
C **   THE FOLLOWING IS A LIST OF THE INPUTS TO THE MODEL - -         **
C **                                                                  **
C **       NAME      REP.VALUE UNITS      DESCRIPTION                 **
C **   REQUIRED INPUT DATA                                            **
C **       APOGEE    500.      NMI        ORBIT APOGEE                **
```

```
C **       EPME      300.      WATTS      MISSION EQUIP POWER REQ.    **
C **       EQM1WT    435.      LB         MISS.EQ.WT.-0.IF NO M.E. 1  **
C **       EQM2WT    435.      LB         MISS.EQ.WT.-0.IF NO M.E. 2  **
C **       IPRINT    1         ---        1=SYS,2=S/S,3-ASSEMBLY      **
C **       MICRO     0         ---        MICRO (S/S) FLAG            **
C **       NFV       4         ---        NO. FLITE VEHICLES          **
C **       NQV       1         ---        NO. QUAL. VEHICLES          **
C **       PERIGE    500.      NMI        ORBIT PERIGEE               **
```

```
C **       SPEC6     0.6       ---        SYS. REL. AT EOL            **
C **       SPEC1     18.       MO         SYS. MMD REQ.               **
C **       T         24.       MO         MISSION LIFETIME            **
C **                                                                  **
C **   DESIRABLE INPUT DATA                                           **
C **       ARRAYN                         MISSION DATA FOR UP TO 3 EQ. **
C **       CGEEX     2.        ---        LOC.OF EXT.EQ.(FT,CENT,AFT) **
C **       EELOC     3.        ---        LOC.OF EXT.EQ.(RT,LFT,TOP,BOT)**
```

CONT. ON PG 3

```
C **        EEQVL      0.          FT**3      EXT. EQ. VOLUMES                   **
C **        EEQWT      0.          LB         EXT. EQ. WEIGHTS                   **
C **        EM1YCG     0.          IN         M.E. 1 Y-CG                        **
C **        EM1ZCG     0.          IN         M.E. 1 Z-CG                        **
C **        EM2YCG     0.          IN         M.E. 2 Y-CG                        **
C **        EM2ZCG     0.          IN         M.E. 2 Z-CG                        **
C **        EQM1XL     40.         IN         M.E. 1 LENGTH                      **
C **        EQM1YL     40.         IN         M.E. 1 WIDTH                       **
```

```
C **        EQM1ZL     40.         IN         M.E. 1 HEIGHT                      **
C **        EQM2XL     40.         IN         M.E. 2 LENGTH                      **
C **        EQM2YL     40.         IN         M.E. 2 WIDTH                       **
C **        EQM2ZL     40.         IN         M.E. 2 HEIGHT                      **
C **        IAGNCY     1           ---        AGENCY TYPE 1=USAF, 2=NASA         **
C **        IMETYP     2           ---        M.E.TYPE,1=COM,2=EO,3=LUN,4=PL**
C **        ISATOR     1           ---        ORIENT. 1=EO,2=SO,3=IO             **
C **        MB12SH     1           ---        M.E.BAY SHAPE,1=CYL,2=BOX          **
```

```
C **        NMSEQ      1           ---        NO. M.E. TT+C DATA ARRAYS          **
C **        NUMEEQ     0           ---        NO. EXT. EQ.                       **
C **        OPSMS      0.          OPS/SEC    NO. MISS. OPS                      **
C **        PHIRX      0.75        DEG        REQ. ROLL  ACCURACY                **
C **        PHIRY      0.75        DEG        REQ. PITCH ACCURACY                **
C **        PHIRZ      0.75        DEG        REQ. YAW   ACCURACY                **
C **        PI         1.0         ---        PRICE INDEX FACTOR                 **
C **        RELME      1.0         ---        M.E. REL. AT EOL                   **
```

```
C **        SKDME      0.          ---        M.E. SKED DATA                     **
C **        XMER       0.          ---        M.E. DDT+E COST                    **
C **        XMEU       0.          ---        M.E. AVG UNIT COST                 **
C **                                                                           **
C **   OPTIONAL INPUT DATA                                                     **
C **        ALPHA      12.0        DEG        THRSTR OFFSET IN ROLL-YAW          **
C **        AX         .05         DEG        MISALIGNMENT ERRORS IN             **
C **        AY         .05         DEG        MOUNTING INERTIA UNITS             **
```

```
C **        AZ         .05         DEG        (3-AXIS MASS EXP. ONLY)            **
C **        BTRMX      1.024 E+06BIT/SEC      MAXIMUM BIT RATE                   **
C **        BWIDTH     2*(-1.E10)HZ           BANDWIDTH FOR XMTR(S)              **
C **        CA         10.         G          AXIAL LAUNCH ACCELRATION           **
C **        CE         5.          G          LATERAL LAUNCH ACCELERATION        **
C **        COMRAT     1000.       BAUD       RECEIVER COMMAND RATE              **
C **        DIAMAX     120.        IN         MAXIMUM SATELLITE DIAMETER         **
C **        DPHI       .25         DEG        MAIN ENG.ALIGN TO THRST AXIS       **
```

```
C **        EA         .10         DEG        ANTENNA MISALIGNMENT(PM ONLY)      **
C **        EANT       .1          RAD        ANTENNA ELEVATION    (PM ONLY)     **
C **        EP1        .0001       DEG/SEC    MAX PGM PITCHOVER RATE(3-AXIS)**
C **        EQPF       2.          ---        VOLUME SIZING FACTOR               **
C **        FE         4.1         DEG        TRANSLATIONAL THRST(NON-ZERO)      **
C **        FEEPCT     .07         ---        CONTRACTOR FEE PERCENTAGE          **
C **        FREQ       2*(2250.)   MHZ        FREQ OF DOWNLINK XMTR(S)           **
C **        FREQR      1800.       MHZ        RECEIVER FREQUENCY                 **
```

```
C **        IDEBUG     0           ---        0=DEBUG OFF, 1=DEBUG ON            **
C **        IEND1      5           ---        LAST ALLOWABLE FOR SANDC           **
```

CONT. ON PG 4

C **	IEND2	3	---	LAST ALLOWABLE FOR AP	**
C **	IEND3	2	---	LAST ALLOWABLE FOR DPI	**
C **	IEND4	5	---	LAST ALLOWABLE FOR COMM	**
C **	IEND5	6	---	LAST ALLOWABLE FOR EP	**
C **	IEND6	3	---	LAST ALLOWABLE FOR VESIZE	**
C **	IENDR	1	---	LAST ALLOWABLE FOR RELY	**
C **	IOPTCM	0	---	RANGING REQUIREMENT 0=NO,1=YES	**
C **	ISBOFG	0	---	SA BOOM DRIV REQ 0=NO,1=YES	**
C **	ISPT	0	---	SINGLE PT FAIL REQ 0=NO	**
C **	ISTRT1	1	---	FIRST ALLOWABLE FOR SANDC	**
C **	ISTRT2	1	---	FIRST ALLOWABLE FOR AP	**
C **	ISTRT3	1	---	FIRST ALLOWABLE FOR DPI	**
C **	ISTRT4	1	---	FIRST ALLOWABLE FOR COMM	**
C **	ISTRT5	1	---	FIRST ALLOWABLE FOR EP	**
C **	ISTRT6	1	---	FIRST ALLOWABLE FOR VESIZE	**
C **	ISTRTR	0	---	FIRST ALLOWABLE FOR RELY	**
C **	ISUB	0	---	S/S REL FLAG 1=AT LEAST 1 S/S	**
C **	K	1	---	AXIS RELATIVITY (DUAL-SPIN)	**
C **	KEOPT	1	---	EXPENSE OPT IND	**
C **	LINK	1	---	COMM LINK(0=USB,1=SGLS)	**
C **	MANV	1	---	VEH SKEWING FLAG.	**
C **	NADIR	1	---	NADIR COVERAGE FLAG	**
C **	NET	1	---	0=AFSCF NET, 0=NASA NET	**
C **	OMEGR	60.	RPM	SPIN RATE OF ROTOR	**
C **	OPTEMP	15.	DEG C	BATT. TEMP.	**
C **	ORBINC	28.5	DEG	ORBITAL INCLINATION	**
C **	PDOTAV	.01	DEG/SEC	AVG BODY RATE LO ORBIT CMG ONL	**
C **	PDOTRX	.012	DEG/SEC	REQ SYS RATE ACC. X	**
C **	PDOTRY	.012	DEG/SEC	REQ SYS RATE ACC. Y	**
C **	PDOTRZ	.012	DEG/SEC	REQ SYS RATE ACC. Z	**
C **	PDOTST	.0667	DEG/SEC	MAX RATE STAR RATE INFO(CMG)	**
C **	PDOTX	1.	DEG/SEC	MAX MANV. RATE X	**
C **	PDOTY	1.	DEG/SEC	MAX MANV. RATE Y	**
C **	PDOTZ	1.	DEG/SEC	MAX MANV. RATE Z	**
C **	PDOTO	1.	DEG/SEC	MAX INIT. RATE	**
C **	PHIFOV	40.0	DEG.	MAX RNG ATT FROM TRK STAR(CMG)	**
C **	RFIXED	1.	---	INITIAL SYSTEM RELIABILITY	**
C **	SCSFL	0.	---	SPEC. CMD SYNC FLG 0=NO 1=YES	**
C **	SLBMX	50000.	LB	MAXIMUM SYSTEM WEIGHT	**
C **	SPEC(1)	.9	---	SANDC S/S REL. REQ.	**
C **	SPEC(2)	.9	---	AP S/S REL. REQ.	**
C **	SPEC(3)	.9	---	DPI S/S REL. REQ.	**
C **	SPEC(4)	.9	---	COMM S/S REL. REQ.	**
C **	SPEC(5)	.9	---	EP S/S REL. REQ.	**
C **	TACCEL	20.	SEC.	ACCEL TIME FOR MANV. (CMG)	**
C **	THETMX	180.	DEG.	MAX MANV ANGLE(CMG ONLY)	**
C **	THOLD	100000.	MIN	TIME VEH.INERT HOLD (CMG)	**
C **	TL	1.0	DAY	TIME BTWN UNLOAD WHL MMNT(CMG)	**
C **	TPMIN	1.0	SEC.	MIN P/L SCAN PERIOD	**
C **	TPRFL	0.	---	TLMTRY PROG FLG 0=SEPARATE	**

CONT. ON PG 5

```
C **       TSMALL      100.      SEC        MAIN ENG BURN TIME                  **
C **       XCGSA1      1.        ---        LOC SLR PDDLES 1=F,2=C,3=A          **
C **       XCGSA3      1.        ---        LOC BDY MTD SA 1=F,2=C,3=A          **
C **       XN          1.        ---        NO. MANV. ABOUT ROLL AXIS           **
```

```
C **       XNN         21.       DAYS       TIME BTWN SA CORR. (DUAL SPIN)**
C **       XNNN        4.0       ---        NO SING GIMB GYROS (CMG)            **
C **       XNU         3.0       ---        CONTROL SYSTEM EFFICIENCY           **
C **       YN          1.        ---        NO. MANV ABOUT PITCH AXIS           **
C **       ZN          1.        ---        NO. MANV ABOUT YAW   AXIS           **
C **                                                                            **
C ******************************************************************************
```

```
NAMELIST /REQUIR/         APOGEE,   EPME,     EQM1WT,   EQM2WT,
                                    IPRINT,   MICRO,    NFV,
                          NOV,      PERIGE,   SPEC1,    SPEC6,
                          T
```

```
NAMELIST /DESIRE/         ARRAYN,   CGEEX,    EELOC,    EEQVL,
                          EEQWT,    EM1YCG,   EM1ZCG,   EM2YCG,
                          EM2ZCG,   EQM1XL,   EQM1YL,   EQM1ZL,
                          EQM2XL,   EQM2YL,   EQM2ZL,   IAGNCY,
                          IMETYP,   ISATOR,   MB12SH,   NMSEQ,
                          NUMEEQ,   OPSMS,    PHIRX,    PHIRY,
                          PHIRZ,    PI,       RELME,    SKDME,
                          XMER,     XMEU
```

```
NAMELIST /OPTION/         ALPHA,    AX,       AY,       AZ,
                          BTRMX,    BWIDTH,   CA,       CE,
                          COMRAT,   DIAMAX,   DPHI,     EA,
                          EANT,     EP1,      EQPF,     FE,
                          FEEPCT,   FREQ,     FREQR,    IEND1,
                IDEBUG,   IEND2,    IEND3,    IEND4,    IEND5,
                          IEND6,    IENDR,    IOPTCM,   ISBOFG,
                          ISPT,     ISTRT1,   ISTRT2,   ISTRT3,
```

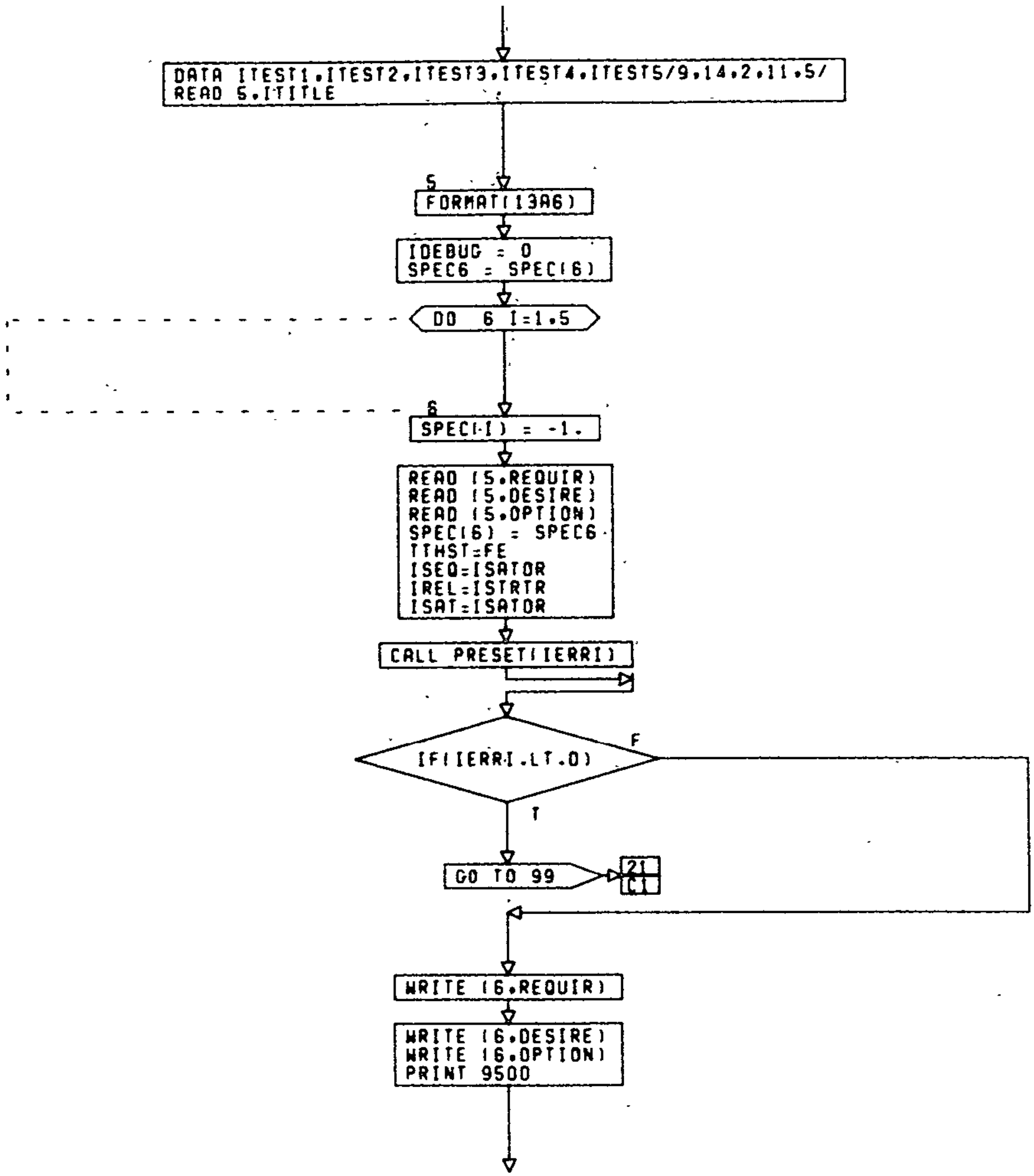
```
                          ISTRT4,   ISTRT5,   ISTRT6,   ISTRTR,
                          ISUB,     K,        KEOPT,    LINK,
                          MANV,     NADIR,    NET,      OMEGR,
                                    OPTEMP,   ORBINC,   PDOTAV,
                          PDOTRX,   PDOTRY,   PDOTRZ,   PDOTST,
                          PDOTX,    PDOTY,    PDOTZ,    PDOTO,
                          PHIFOV,   RFIXED,   SCSFL,    SLBMX,
                          SPEC,               TACCEL,
```

```
                                              THETMX,   THOLD,
                          TL,       TPMIN,    TPRFL,    TSMALL,
                          XCGSA1,   XCGSA3,   XN,       XNN,
                          XNNN,     XNU,      YN,       ZN
```

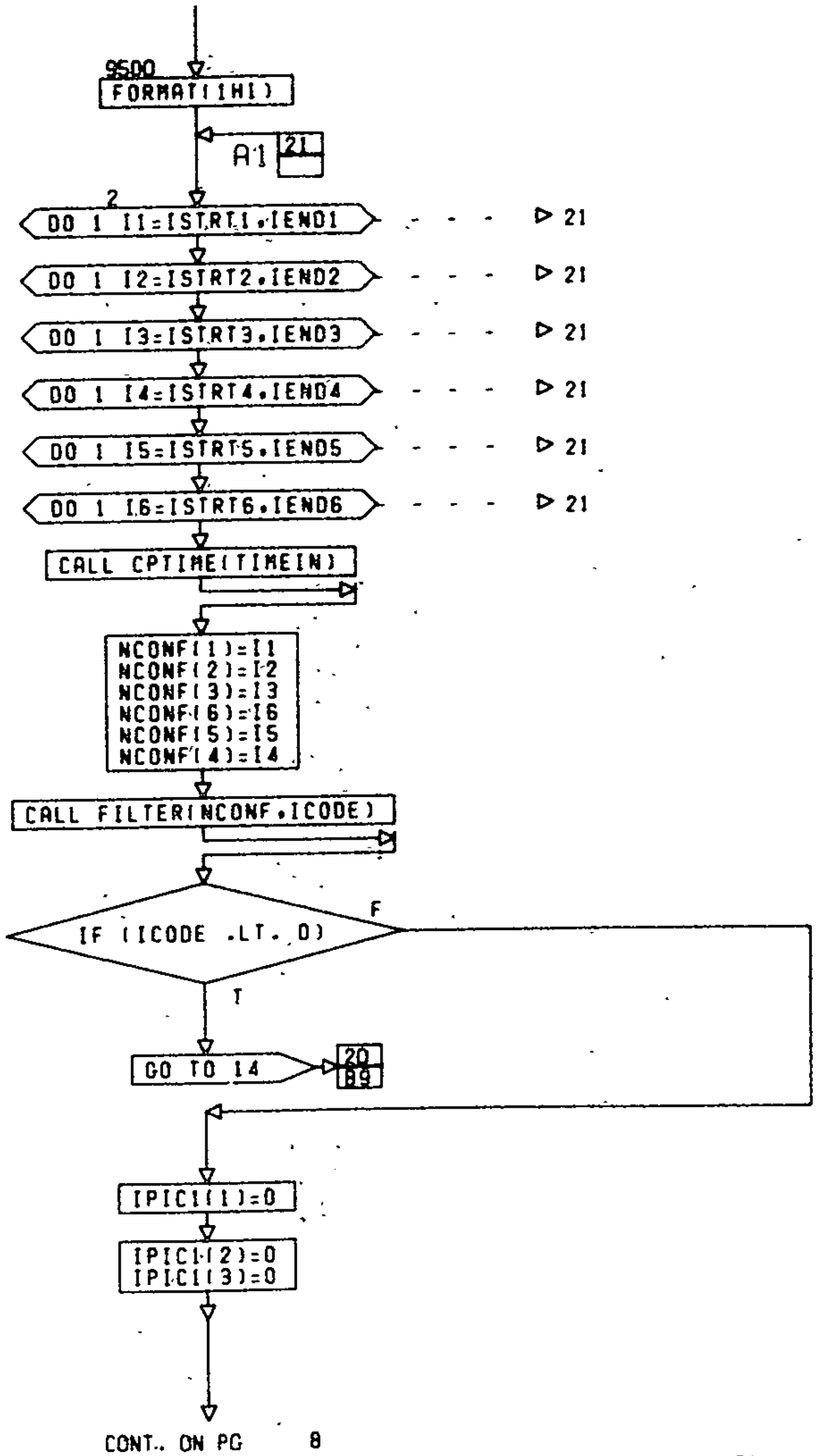
```
DATA NEQUIP,NACCEP/6*0/
```

```
DATA ISTRT1,IEND1,ISTRT2,IEND2,ISTRT3,IEND3,ISTRT4,IEND4,ISTRT5,
IEND5,ISTRT6,IEND6,ISTRTR,IENDR/1,5,1,3,1,2,1,5,1,6,1,3,0,1/
```

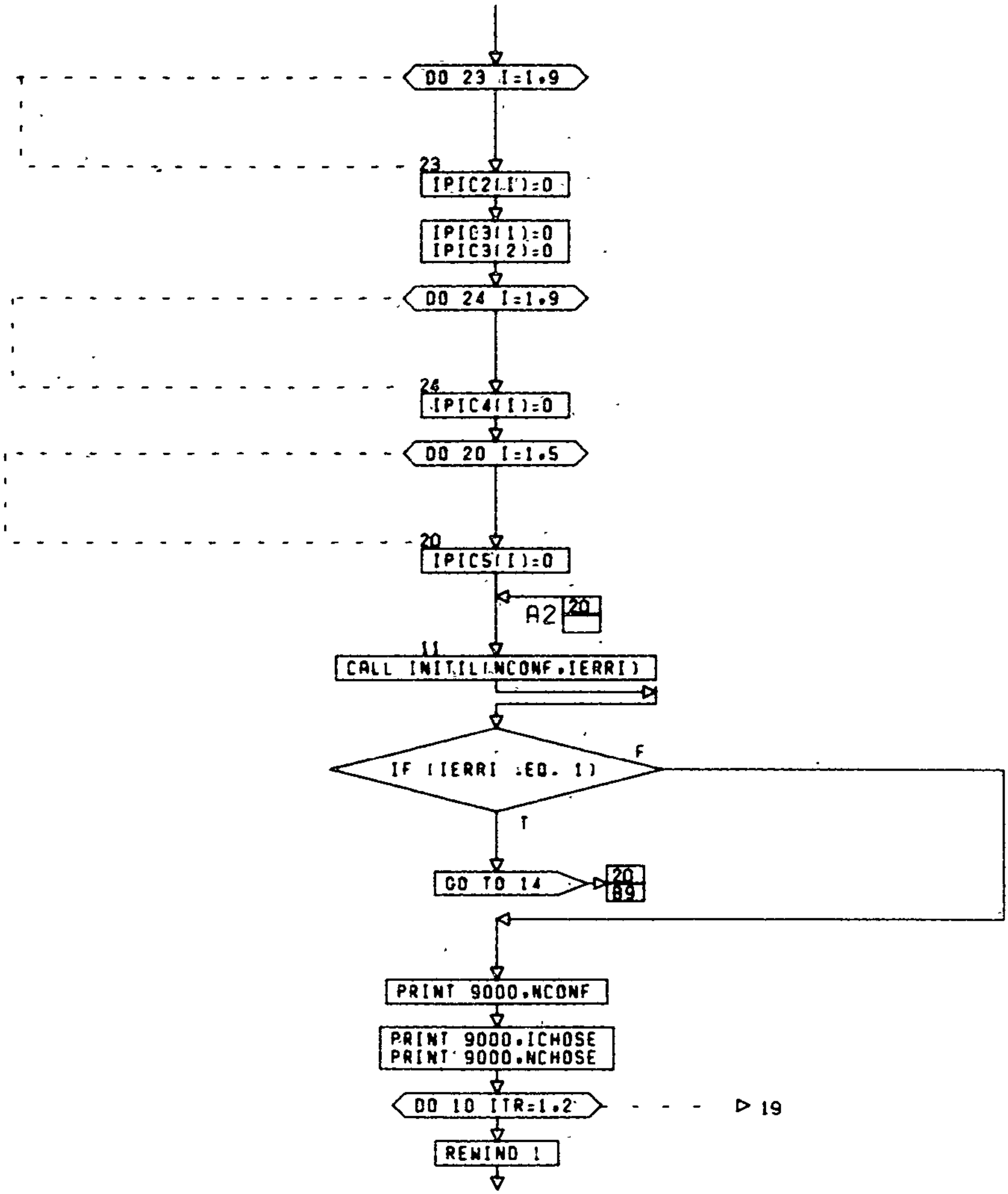
CONT. ON PG 6


DATA ITEST1,ITEST2,ITEST3,ITEST4,ITEST5/9,14,2,11,5/
READ 5,ITITLE
5
FORMAT(13A6)
IDEBUG = 0
SPEC6 = SPEC(6)
DO 6 I=1,5
6
SPEC(I) = -1.
READ (5,REQUIR)
READ (5,DESIRE)
READ (5,OPTION)
SPEC(6) = SPEC6
TTHST=FE
ISEQ=ISATOR
IREL=ISTRTR
ISAT=ISATOR
CALL PRESET(IERRI)
IF(IERRI.LT.0)
F
T
GO TO 99
21
C1
WRITE (6,REQUIR)
WRITE (6,DESIRE)
WRITE (6,OPTION)
PRINT 9500

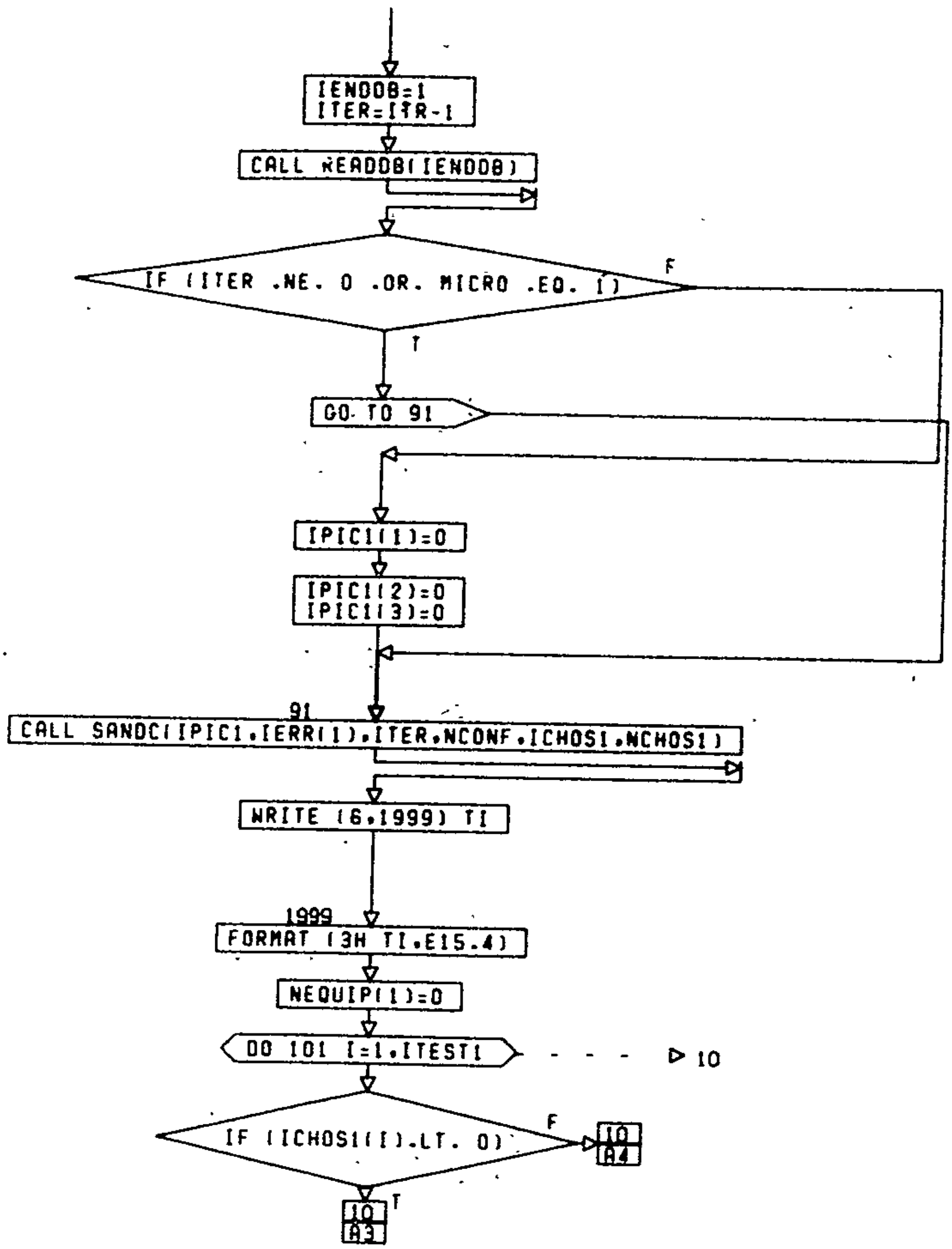
CONT. ON PG 7


9500
FORMAT(1H1)
A1
21
2
DO 1 I1=ISTRT1,IEND1
DO 1 I2=ISTRT2,IEND2
DO 1 I3=ISTRT3,IEND3
DO 1 I4=ISTRT4,IEND4
DO 1 I5=ISTRT5,IEND5
DO 1 I6=ISTRT6,IEND6
21
21
21
21
21
21
CALL CPTIME(TIMEIN)
NCONF(1)=I1
NCONF(2)=I2
NCONF(3)=I3
NCONF(6)=I6
NCONF(5)=I5
NCONF(4)=I4
CALL FILTER(NCONF,ICODE)
IF (ICODE .LT. 0)
F
T
GO TO 14
20
B9
IPIC1(1)=0
IPIC1(2)=0
IPIC1(3)=0

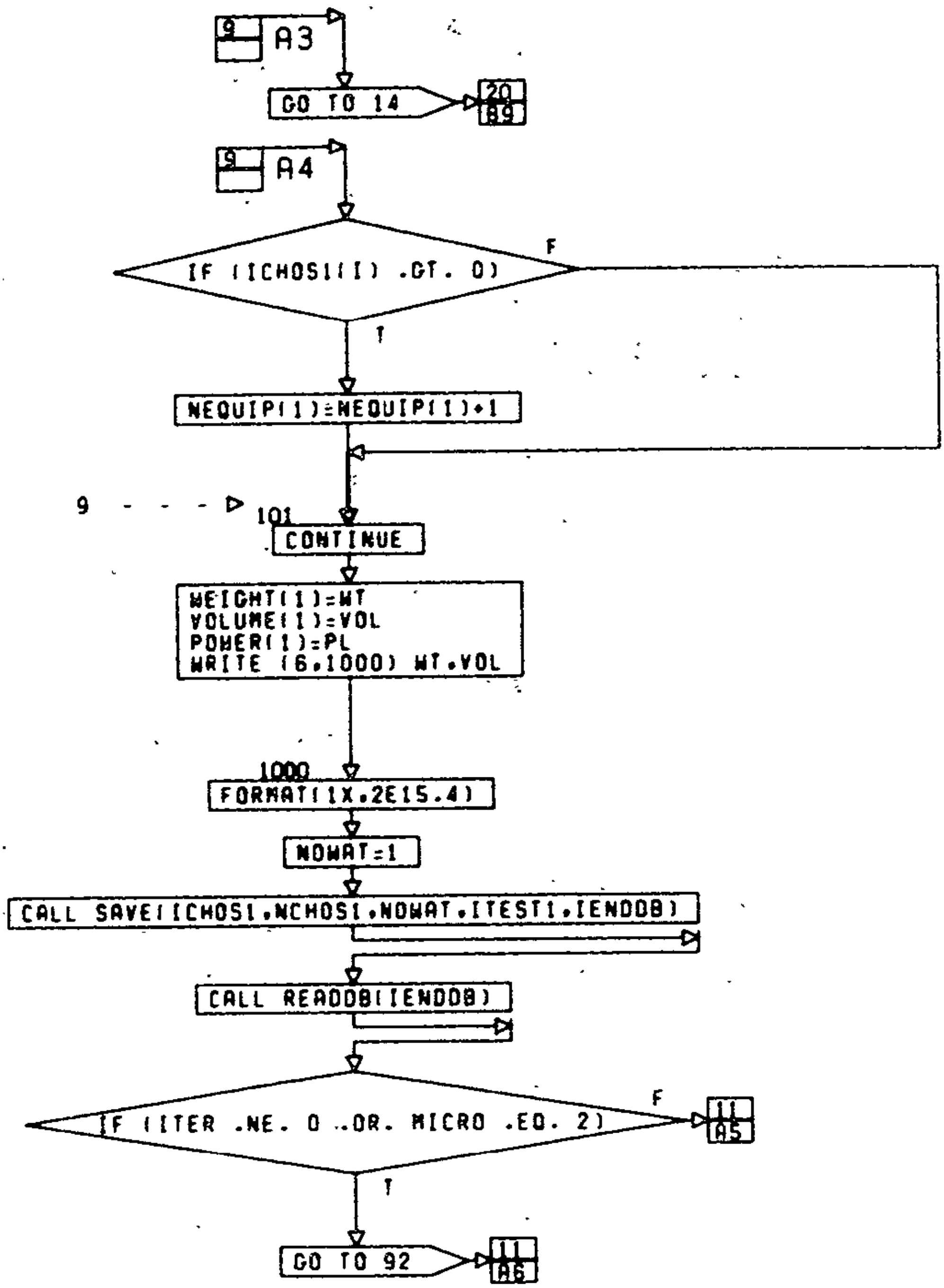
CONT.. ON PG 8


DO 23 I=1,9
23
IPIC2(I)=0
IPIC3(1)=0
IPIC3(2)=0
DO 24 I=1,9
24
IPIC4(I)=0
DO 20 I=1,5
20
IPIC5(I)=0
A2
20
11
CALL INITIL(NCONF,IERR)
IF (IERR .EQ. 1)
F
T
GO TO 14
20
89
PRINT 9000,NCONF
PRINT 9000,ICHOSE
PRINT 9000,NCHOSE
DO 10 ITR=1,2
19
REWIND 1

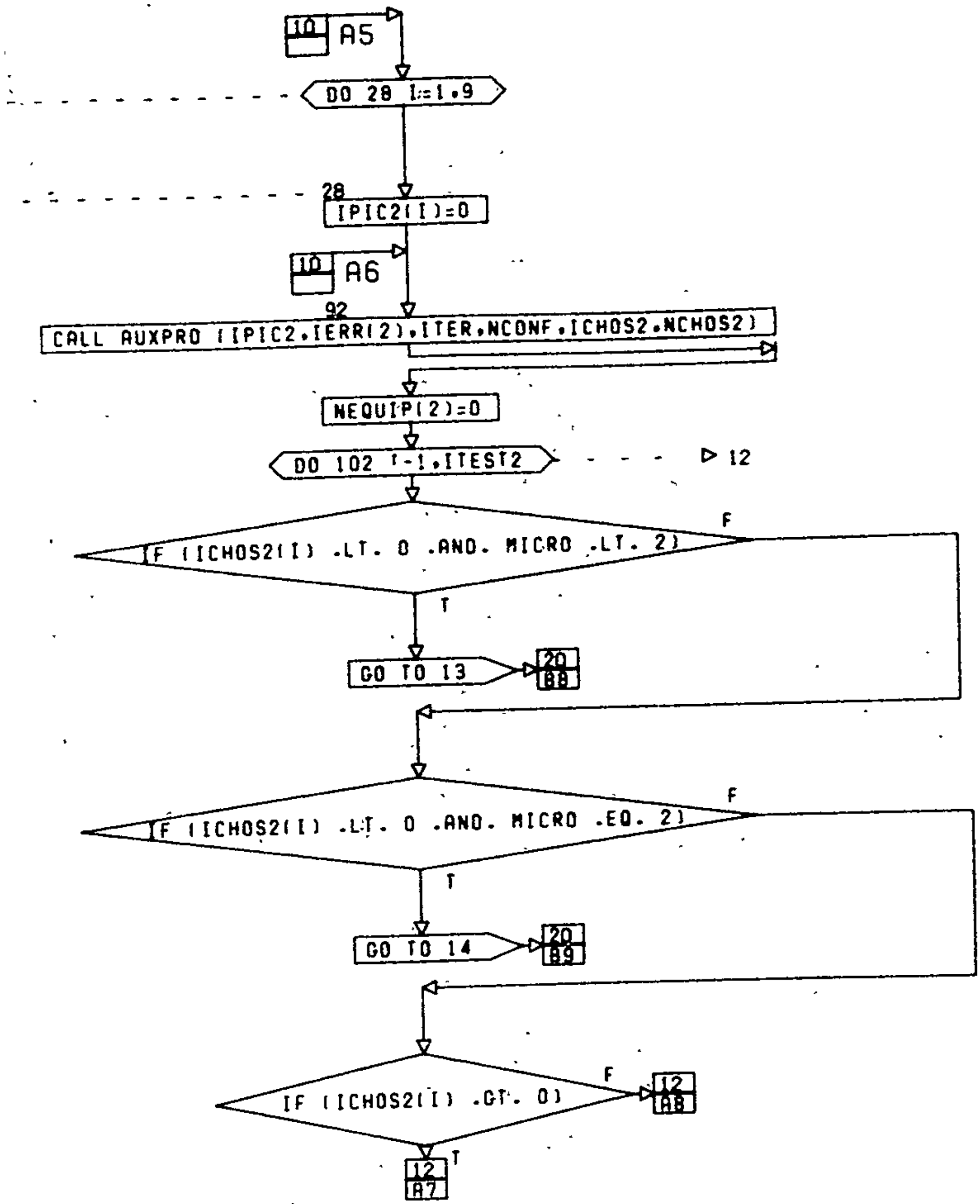
CONT. ON PG 9


IENDDB=1
ITER=ITR-1
CALL READDB(IENDDB)
IF (ITER .NE. 0 .OR. MICRO .EQ. 1)
F
T
GO TO 91
IPIC1(1)=0
IPIC1(2)=0
IPIC1(3)=0
91
CALL SANDC(IPIC1,IERR(1),ITER,NCONF,ICHOS1,NCHOS1)
WRITE (6,1999) TI
1999
FORMAT (3H TI,E15.4)
NEQUIP(1)=0
DO 101 I=1,ITEST1
10
IF (ICHOS1(I).LT. 0)
F
10
A4
T
10
A3

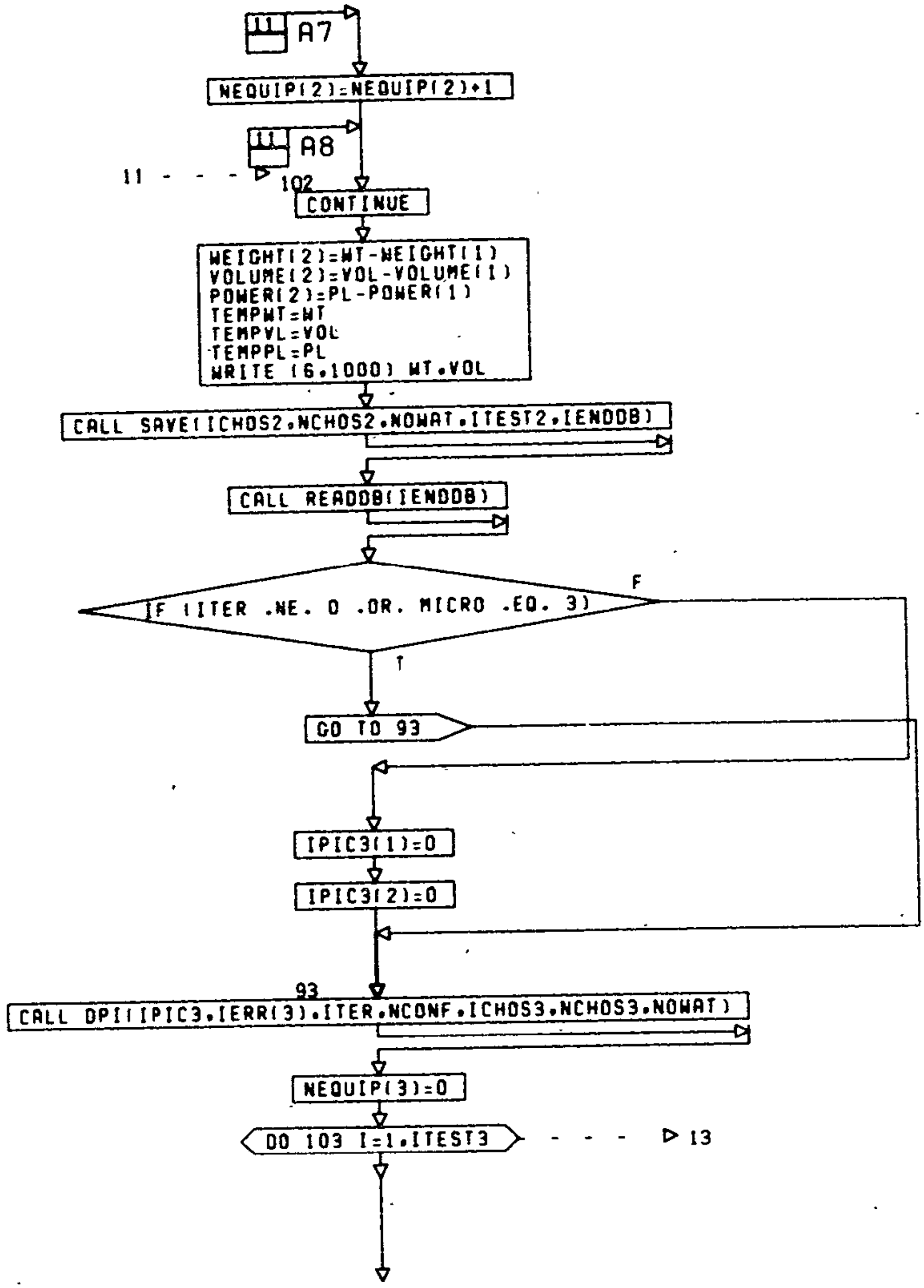
CONT. ON PG 10


9 A3
GO TO 14
20 B9
9 A4
IF (ICHOS1(I) .GT. 0)
F
T
NEQUIP(I)=NEQUIP(I)+1
9
101
CONTINUE
WEIGHT(I)=WT
VOLUME(I)=VOL
POWER(I)=PL
WRITE (6,1000) WT,VOL
1000
FORMAT(1X,2E15.4)
NOWAT=1
CALL SAVE(ICHOS1,NCHOS1,NOWAT,ITEST1,IENDDB)
CALL READDB(IENDDB)
IF (ITER .NE. 0 .OR. MICRO .EQ. 2)
F
11 A5
T
GO TO 92
11 A6

CONT. ON PG 11

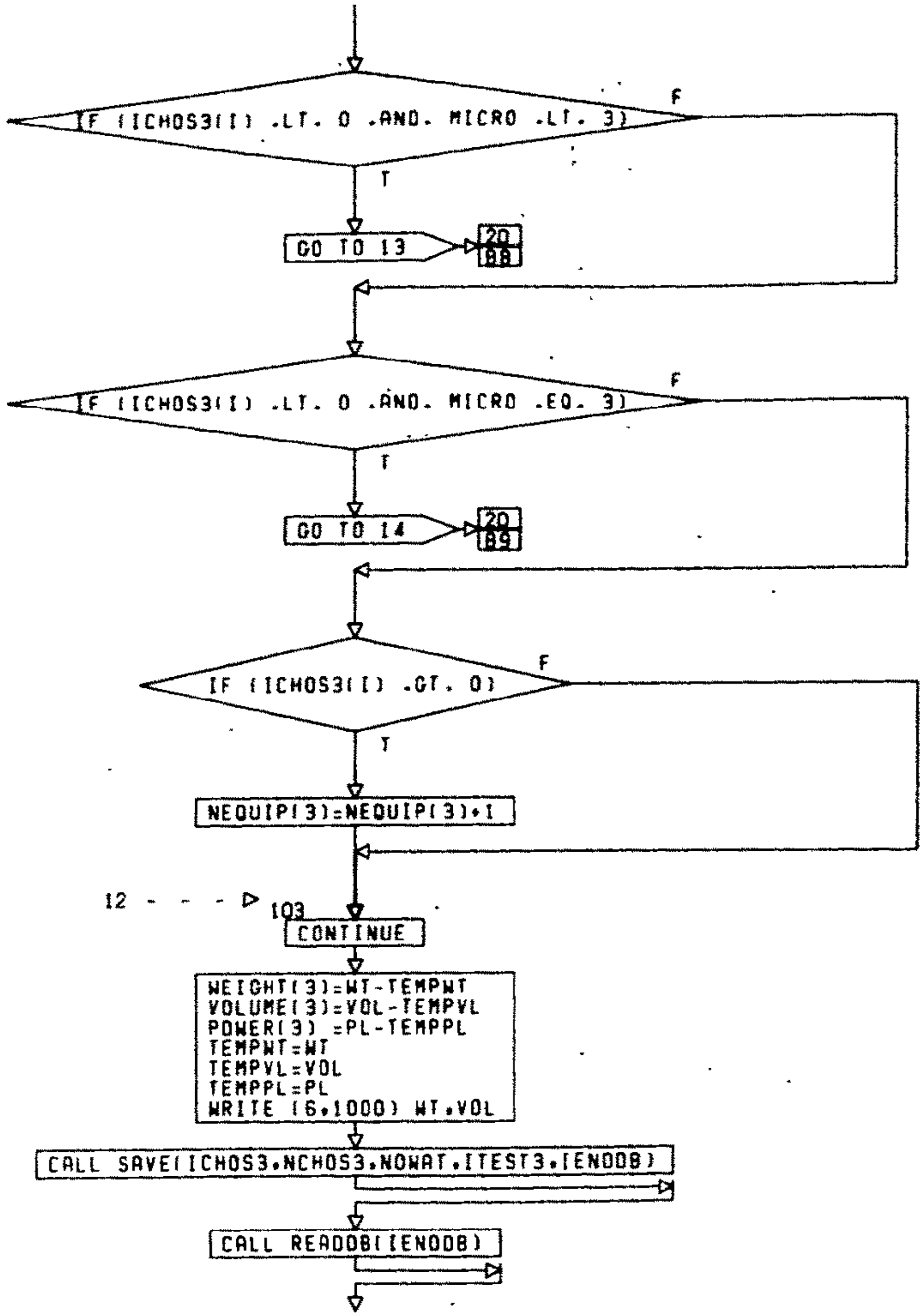

10
A5
DO 28 I=1,9
28
IPIC2(I)=0
10
A6
92
CALL AUXPRO (IPIC2,IERR(2),ITER,NCONF,ICHOS2,NCHOS2)
NEQUIP(2)=0
DO 102 I=1,ITEST2
12
IF (ICHOS2(I) .LT. 0 .AND. MICRO .LT. 2)
F
T
GO TO 13
20
B8
IF (ICHOS2(I) .LT. 0 .AND. MICRO .EQ. 2)
F
T
GO TO 14
20
B9
IF (ICHOS2(I) .GT. 0)
F
12
A8
T
12
A7

CONT. ON PG 12

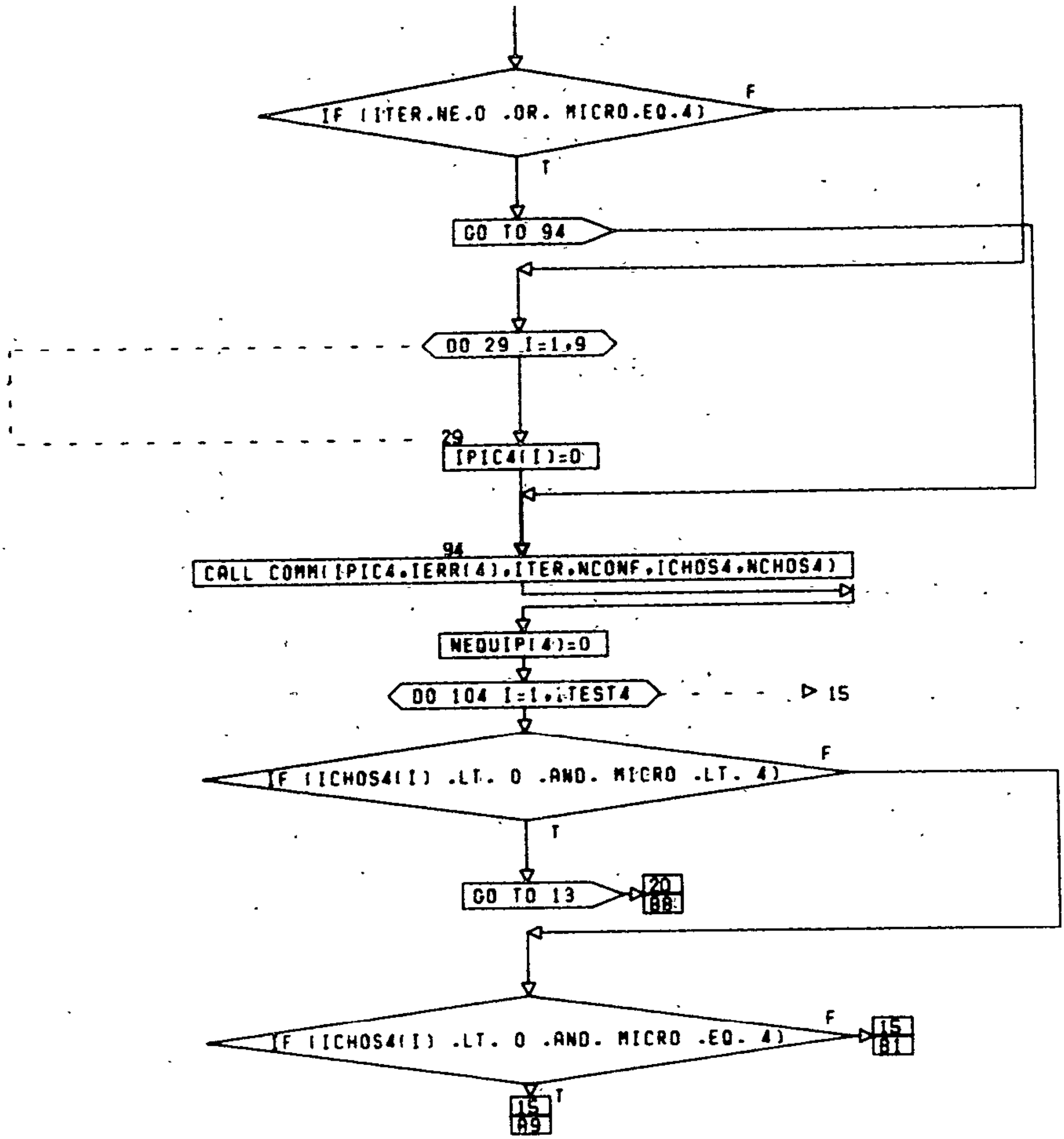


11
A7
NEQUIP(2)=NEQUIP(2)+1
11
A8
11
102
CONTINUE
WEIGHT(2)=WT-WEIGHT(1)
VOLUME(2)=VOL-VOLUME(1)
POWER(2)=PL-POWER(1)
TEMPWT=WT
TEMPVL=VOL
TEMPPL=PL
WRITE (6,1000) WT,VOL
CALL SAVE(ICHOS2,NCHOS2,NOWAT,ITEST2,IENDDB)
CALL READDB(IENDDB)
IF (ITER .NE. 0 .OR. MICRO .EQ. 3)
F
T
GO TO 93
IPIC3(1)=0
IPIC3(2)=0
93
CALL DPI(IPIC3,IERR(3),ITER,NCONF,ICHOS3,NCHOS3,NOWAT)
NEQUIP(3)=0
DO 103 I=1,ITEST3
13

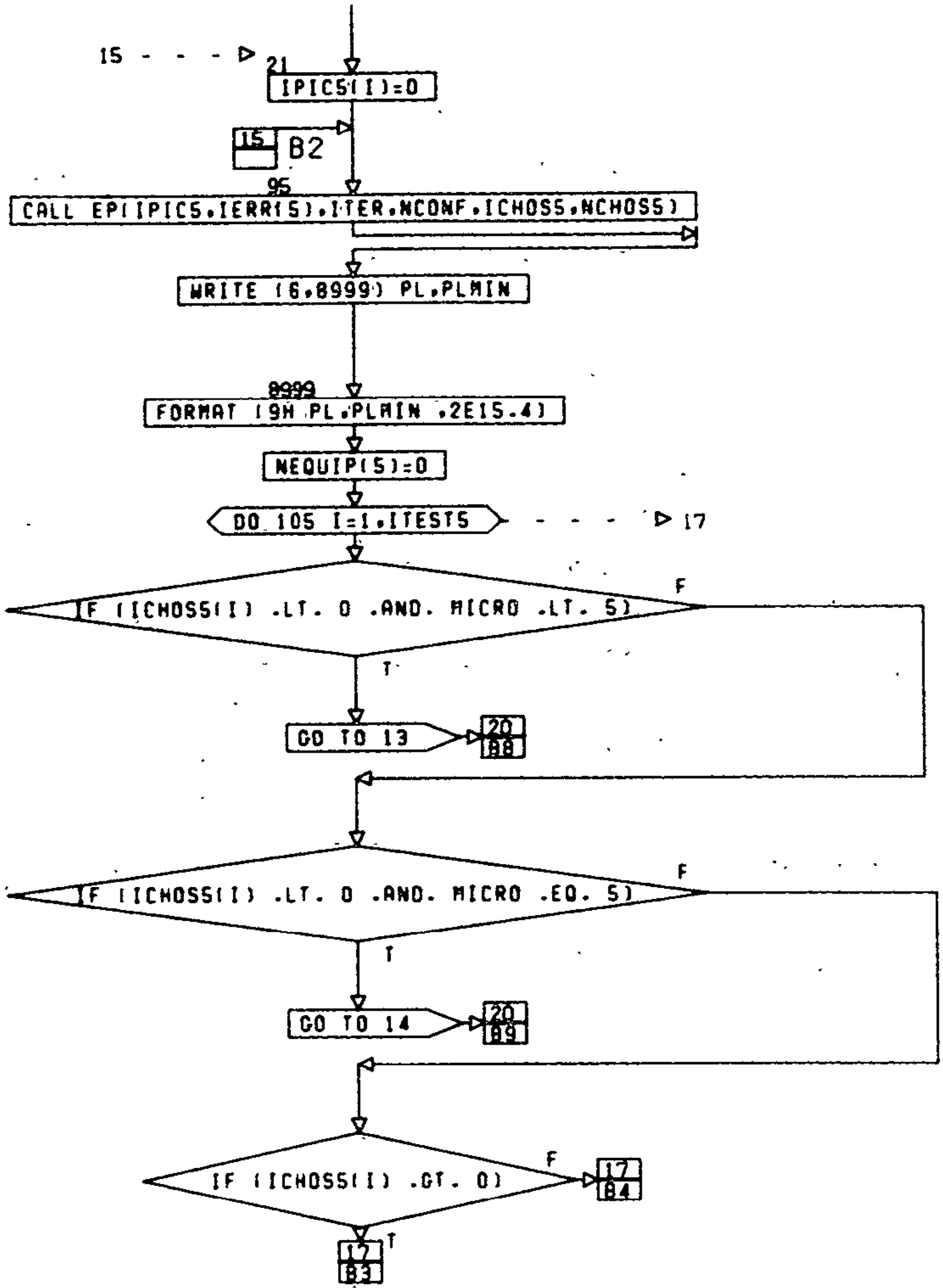
CONT. ON PG 13


IF (ICHOS3(I) .LT. 0 .AND. MICRO .LT. 3)
F
T
GO TO 13
20
88
IF (ICHOS3(I) .LT. 0 .AND. MICRO .EQ. 3)
F
T
GO TO 14
20
89
IF (ICHOS3(I) .GT. 0)
F
T
NEQUIP(3)=NEQUIP(3)+1
12
103
CONTINUE
WEIGHT(3)=WT-TEMPWT
VOLUME(3)=VOL-TEMPVL
POWER(3) =PL-TEMPPL
TEMPWT=WT
TEMPVL=VOL
TEMPPL=PL
WRITE (6,1000) WT,VOL
CALL SAVE(ICHOS3,NCHOS3,NOWAT,ITEST3,IENODB)
CALL READDB(IENODB)

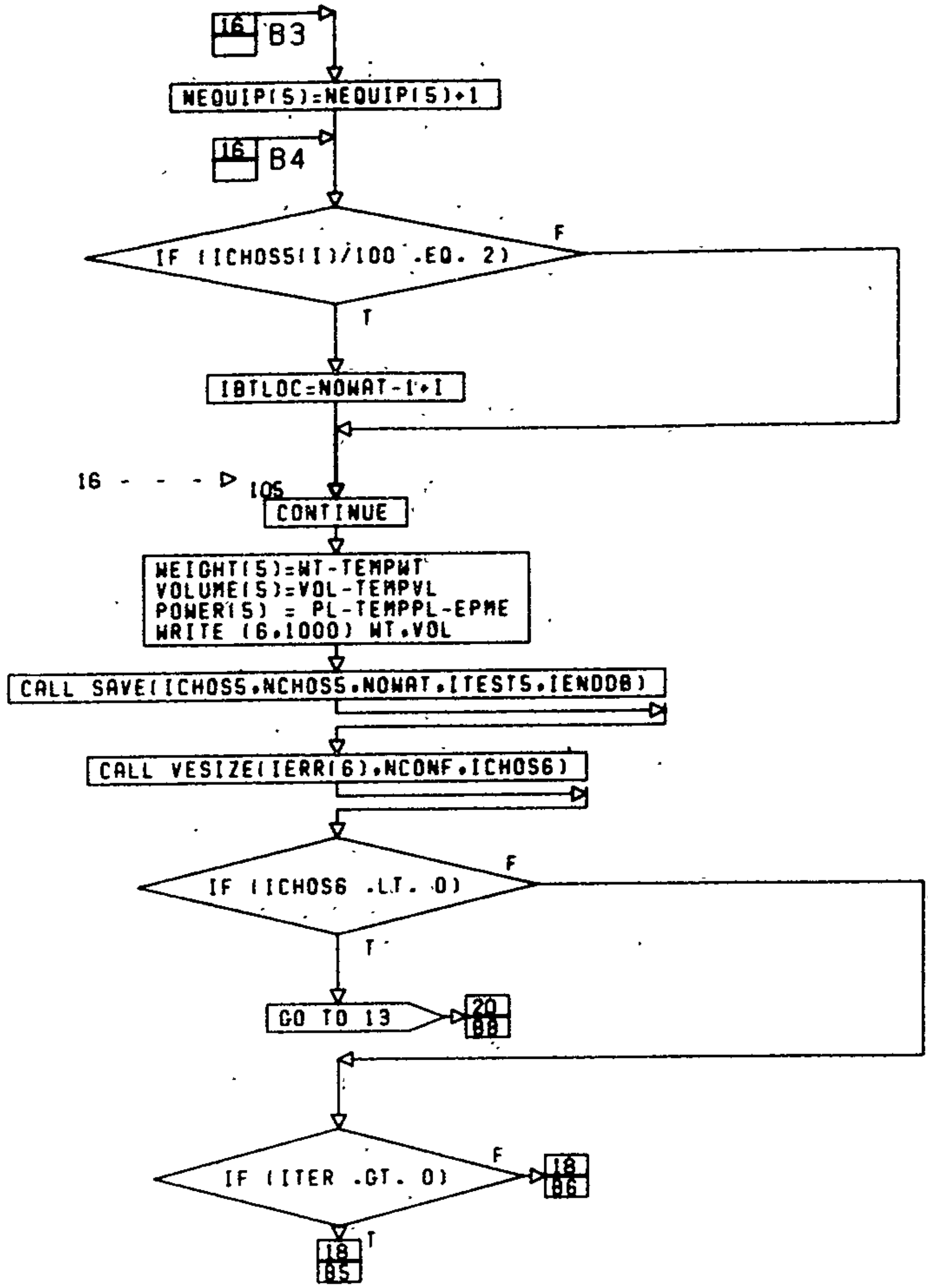
CONT. ON PG 14


IF (ITER.NE.0 .OR. MICRO.EQ.4)
F
T
GO TO 94
DO 29 I=1,9
29
IPIC4(I)=0
94
CALL COMM(IPIC4,IERR(4),ITER,NCONF,ICHOS4,NCHOS4)
NEQUIP(4)=0
DO 104 I=1,ITEST4
15
IF (ICHOS4(I) .LT. 0 .AND. MICRO .LT. 4)
F
T
GO TO 13
20
B8
IF (ICHOS4(I) .LT. 0 .AND. MICRO .EQ. 4)
F
15
B1
T
15
A9

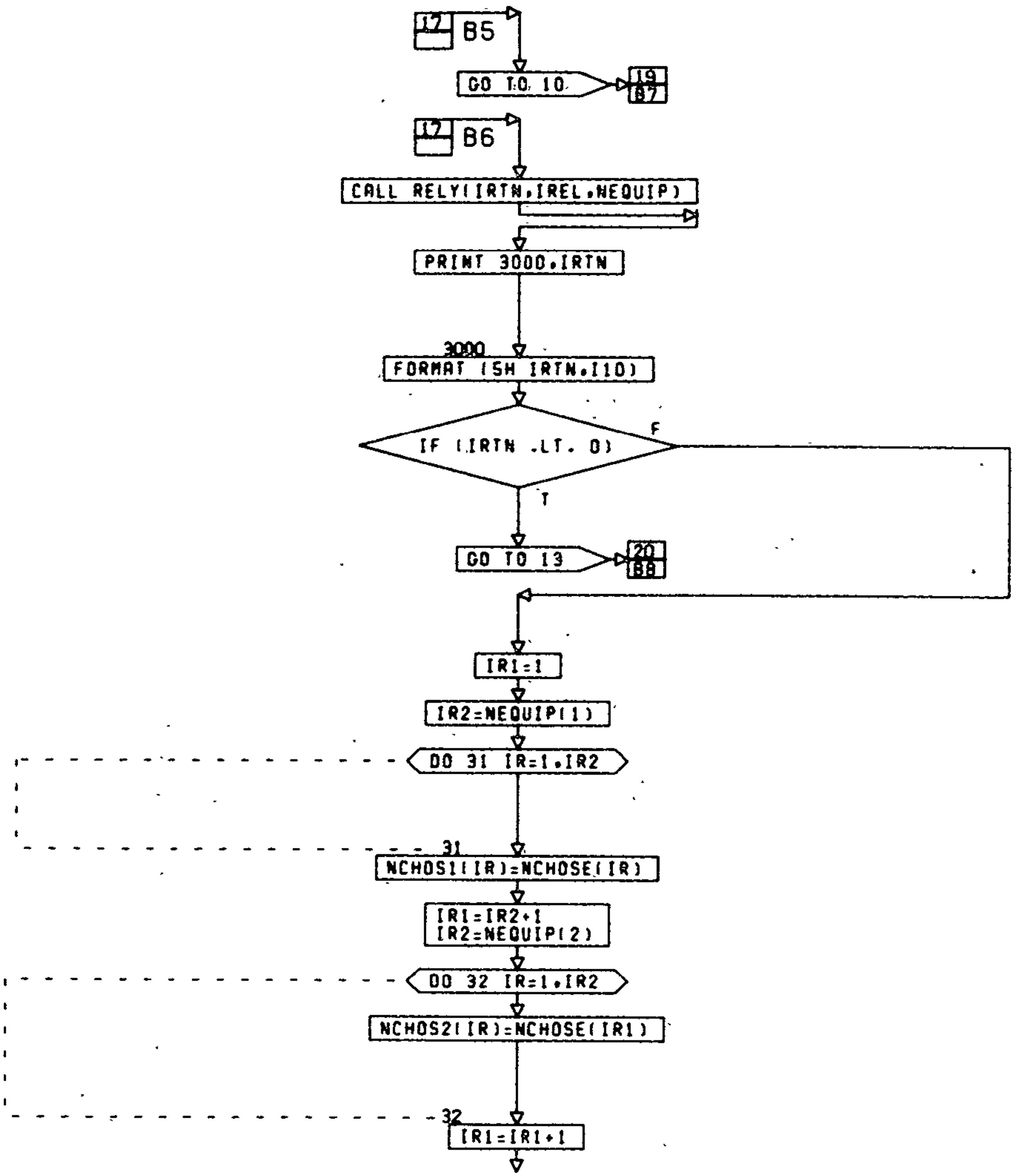
CONT. ON PG 15


15 - - - ▷ 21
IPICS(I)=0
15
B2
95
CALL EP(IPICS,IERR(5),ITER,NCONF,ICHOSS,NCHOSS)
WRITE (6,8999) PL,PLMIN
8999
FORMAT (9H PL,PLMIN ,2E15.4)
NEQUIP(5)=0
DO 105 I=1,ITESTS
▷ 17
IF (ICHOSS(I) .LT. 0 .AND. MICRO .LT. 5)
F
T
GO TO 13
20
B8
IF (ICHOSS(I) .LT. 0 .AND. MICRO .EQ. 5)
F
T
GO TO 14
20
B9
IF (ICHOSS(I) .GT. 0)
F
17
B4
T
17
B3

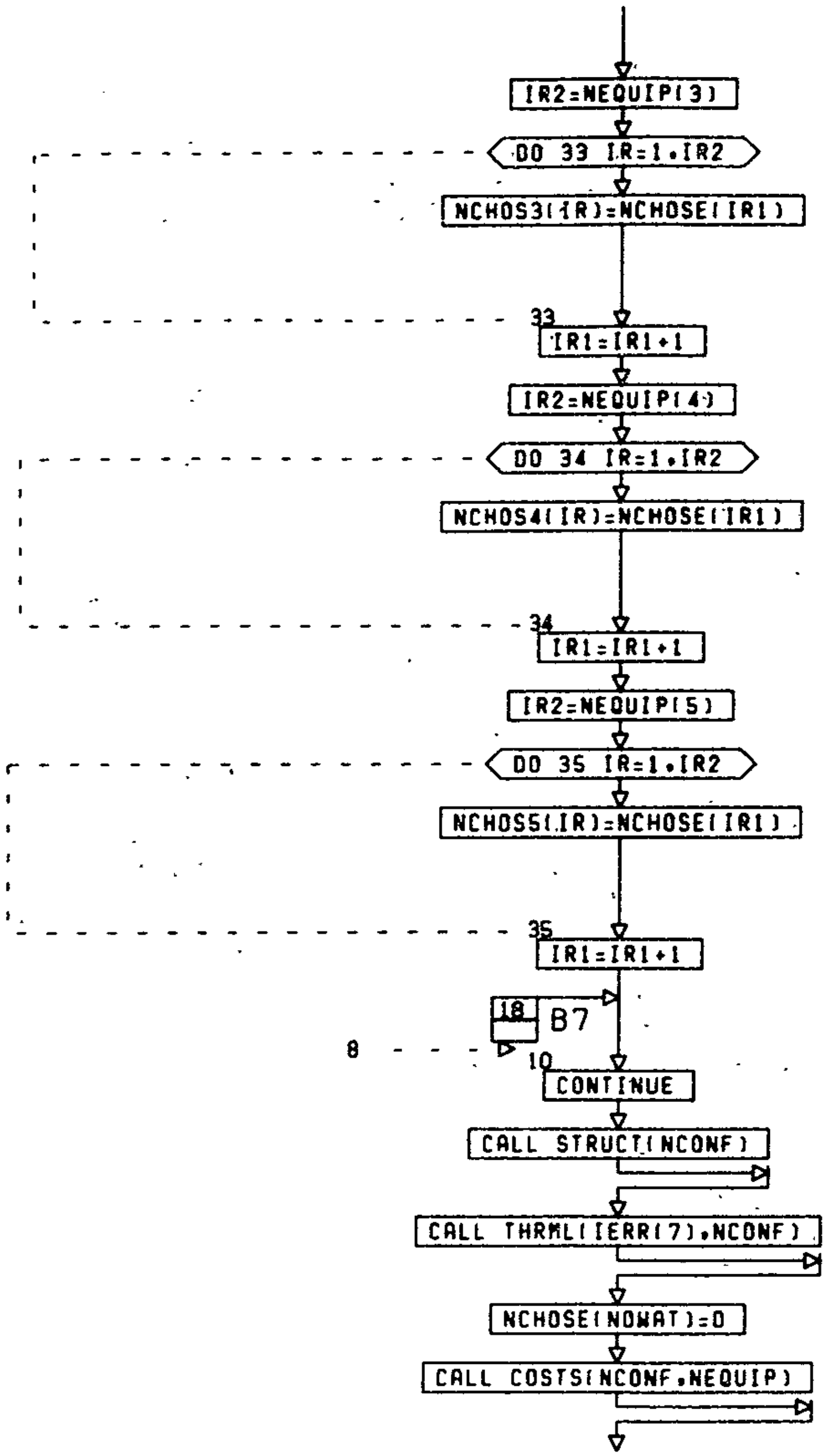
CONT. ON PG 17


16 B3
NEQUIP(5)=NEQUIP(5)+1
16 B4
IF (ICHOS5(I)/100 .EQ. 2)
F
T
IBTLOC=NOWAT-1+I
16
105
CONTINUE
WEIGHT(5)=WT-TEMPWT
VOLUME(5)=VOL-TEMPVL
POWER(5) = PL-TEMPPL-EPME
WRITE (6,1000) WT,VOL
CALL SAVE(ICHOS5,NCHOS5,NOWAT,ITESTS,IENDDB)
CALL VESIZE(IERR(6),NCONF,ICHOS6)
IF (ICHOS6 .LT. 0)
F
T
GO TO 13
20 B8
IF (ITER .GT. 0)
F
18 B6
T
18 B5

CONT. ON PG 18

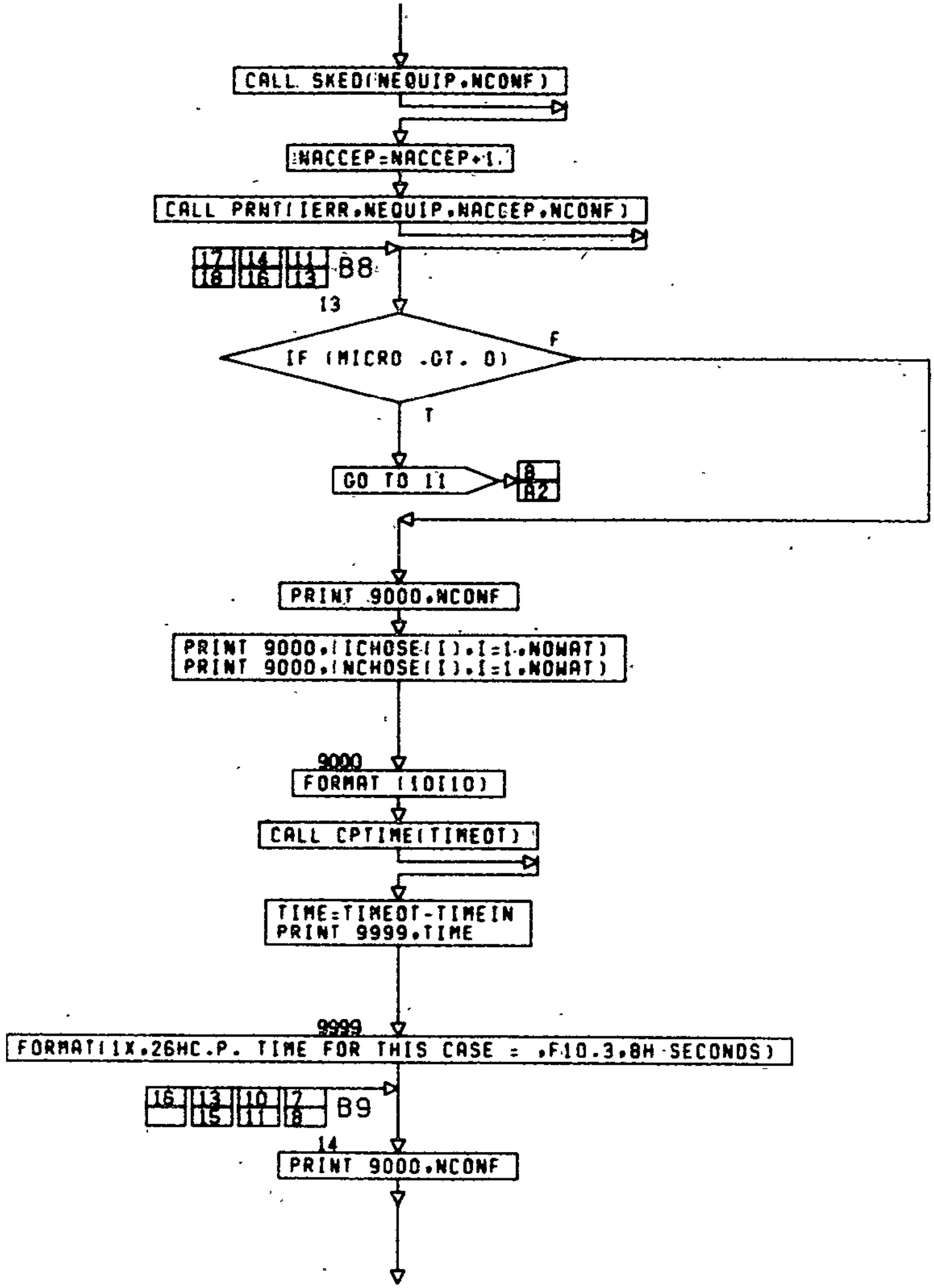

17 B5
GO TO 10
19 B7
17 B6
CALL RELY(IRTN,IREL,NEQUIP)
PRINT 3000,IRTN
3000
FORMAT (5H IRTN,I10)
IF (IRTN .LT. 0)
F
T
GO TO 13
20 B8
IR1=1
IR2=NEQUIP(1)
DO 31 IR=1,IR2
31
NCHOS1(IR)=NCHOSE(IR)
IR1=IR2+1
IR2=NEQUIP(2)
DO 32 IR=1,IR2
NCHOS2(IR)=NCHOSE(IR1)
32
IR1=IR1+1

CONT. ON PG 19

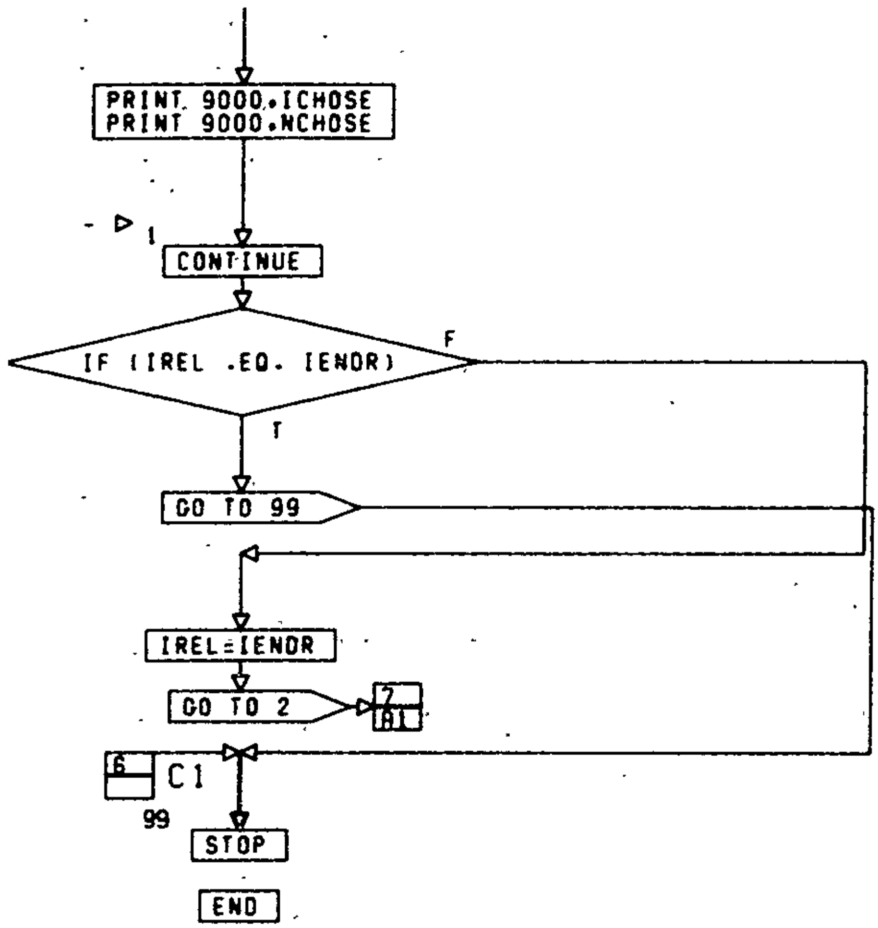


IR2=NEQUIP(3)
DO 33 IR=1,IR2
NCHOS3(IR)=NCHOSE(IR1)
33
IR1=IR1+1
IR2=NEQUIP(4)
DO 34 IR=1,IR2
NCHOS4(IR)=NCHOSE(IR1)
34
IR1=IR1+1
IR2=NEQUIP(5)
DO 35 IR=1,IR2
NCHOS5(IR)=NCHOSE(IR1)
35
IR1=IR1+1
18
B7
8
10
CONTINUE
CALL STRUCT(NCONF)
CALL THRML(IERR(7),NCONF)
NCHOSE(NOWAT)=0
CALL COSTS(NCONF,NEQUIP)

CONT. ON PG 20


CALL SKED(NEQUIP,NCONF)
NACCEP=NACCEP+1.
CALL PRNT(IERR,NEQUIP,NACCEP,NCONF)
17
18
14
16
11
13
B8
13
IF (MICRO .GT. 0)
F
T
GO TO 11
8
A2
PRINT 9000,NCONF
PRINT 9000,(ICHOSE(I),I=1,NOWAT)
PRINT 9000,(NCHOSE(I),I=1,NOWAT)
9000
FORMAT (10I10)
CALL CPTIME(TIMEOT)
TIME=TIMEOT-TIMEIN
PRINT 9999,TIME
9999
FORMAT(1X,26HC.P. TIME FOR THIS CASE = ,F10.3,8H SECONDS)
16
13
15
10
11
7
8
B9
14
PRINT 9000,NCONF

CONT. ON PG 21

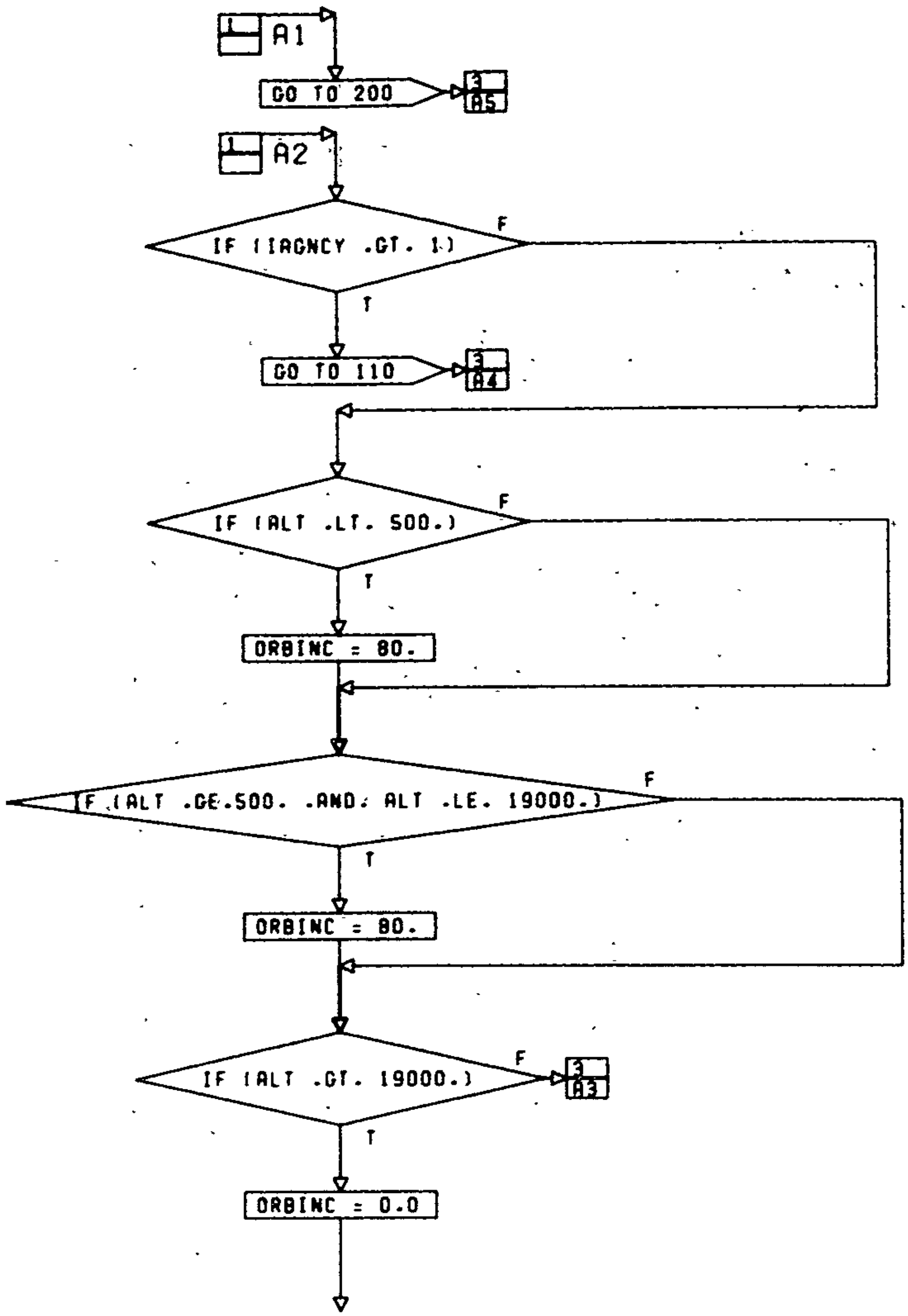


PRINT 9000,ICHOSE
PRINT 9000,NCHOSE
1
CONTINUE
IF (IREL .EQ. IENOR)
F
T
GO TO 99
IREL=IENOR
GO TO 2
7
A1
6
C1
99
STOP
END

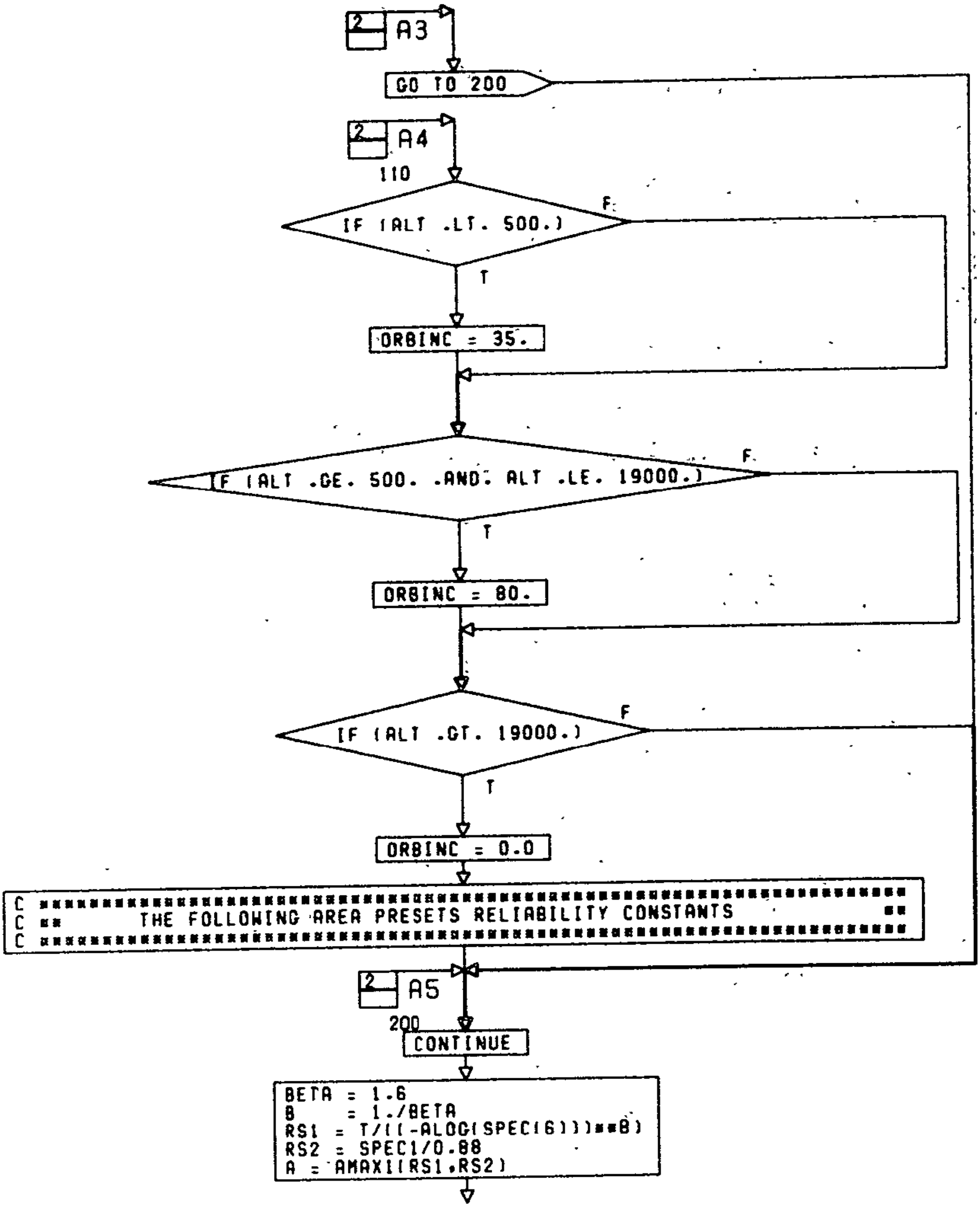
PG 21 FINAL

```
SUBROUTINE PRESET(IERR)

C **  THIS SUBROUTINE CALCULATES WHAT USED TO BE EITHER CONSTANTS OR  **
C **  INPUT VALUES. IT NOW WILL CALCULATE THE VALUES OF THESE         **
C **  CONSTANTS FROM OTHER INPUT VALUES WHERE THEY ARE GIVEN ELSE IT  **
C **  WILL USE THE OLD CONSTANT VALUES.                               **

COMMON /USERI/     ALPHA,     AX,      AY,      AZ,      DPHI,
                   EA,        EANT,    EPI,     K,       MANV,
                   OMEGA,     PDOTAV,  PDOTRX,  PDOTRY,  PDOTRZ,
                   PDOTST,    PDOTX,   PDOTY,   PDOTZ,   PDOTO,
                   PHIFOV,    PHIRX,   PHIRY,   PHIRZ,   TACCEL,
                   THETMX,    THOLD,   TL,      TPMIN,   TSMALL,
                   XN,        XNN,     XNNN,    XNU,     YN,
                   ZN

COMMON /USERR/     ISPT,      ISUB,    KEOPT,   RFIXED,  SLBMX

COMMON /USERI/     APOGEE,    COMRAT,  DIAMAX,  EEQWT(9),  EPME,
                   EQM1WT,    EQM1XL,  EQM1YL,  EQM1ZL,    EQM2WT,
                   EQM2XL,    EQM2YL,  EQM2ZL,  FE,        IAGNCY,
          IDEBUG,  ISATOR,    MB12SH,  OPTEMP,  ORBINC,    PERIGE,
          MICRO,   RELME,     SPEC(6), SPECI,   T,         XCGSA1,
                   XMER,      XMEU

COMMON /BTWN/      ACSSN,     ACSWP,   ALT,     AREA,    BATCAP,
          BITRAT(2),          CLIFE,   CONVWT,  SATDAM,  DT,
                   DX,        DY,      DZ,      EQBLG,   EQBSID,
                   FC,        FF,      HARNWT,  HPT,     HTPIPE,
                   HTPT,      HTRPRB,  HTRPWR,           IBTLOC,
                   LMBDD,     NC,      OMEGS,   PASSTR,  PJ,
                   PL,        PLMIN,   PDCNWT,  RADA,    RADAB,
                   RAT,       RJ,      SABOLG,  SATLG,   SATTWT,

                   SATWT,     SATXCG,  SATYCG,  SATZCG,  SA1XL,
                   SA1YL,     SA1ZL,   SIDE,    SYSLB,   THCMWT,
          THRUST(2),          TI,      TNKWT,   TPRIM,   VB,
                   VCHP,      VOL,     WATE,    WB,      WBT,
                   WT,        XJ,      XNZERO,  YJ,      ZJ

C *****************************************************************
C **      THE FOLLOWING AREA PRESETS THERMAL CONSTANTS           **
C *****************************************************************

ALT =(APOGEE + PERIGE) / 2.0

IF (ORBINC .NE. -360.)    F -> 2/A2
                          T -> 2/A1
```

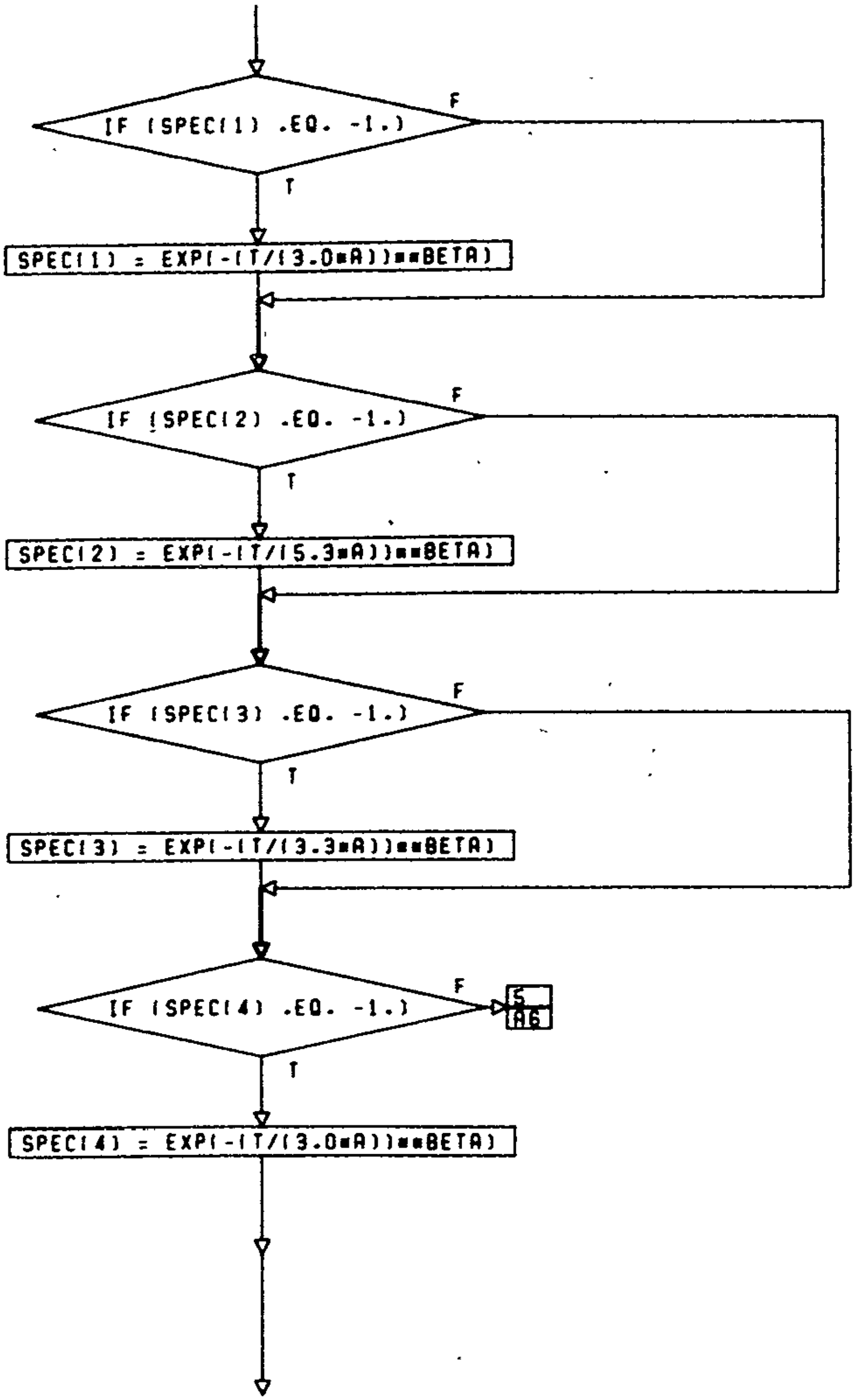
CONT. ON PG 2


A1
GO TO 200
3
A5
A2
IF (IAGNCY .GT. 1)
F
T
GO TO 110
3
A4
IF (ALT .LT. 500.)
F
T
ORBINC = 80.
IF (ALT .GE.500. .AND. ALT .LE. 19000.)
F
T
ORBINC = 80.
IF (ALT .GT. 19000.)
F
3
A3
T
ORBINC = 0.0

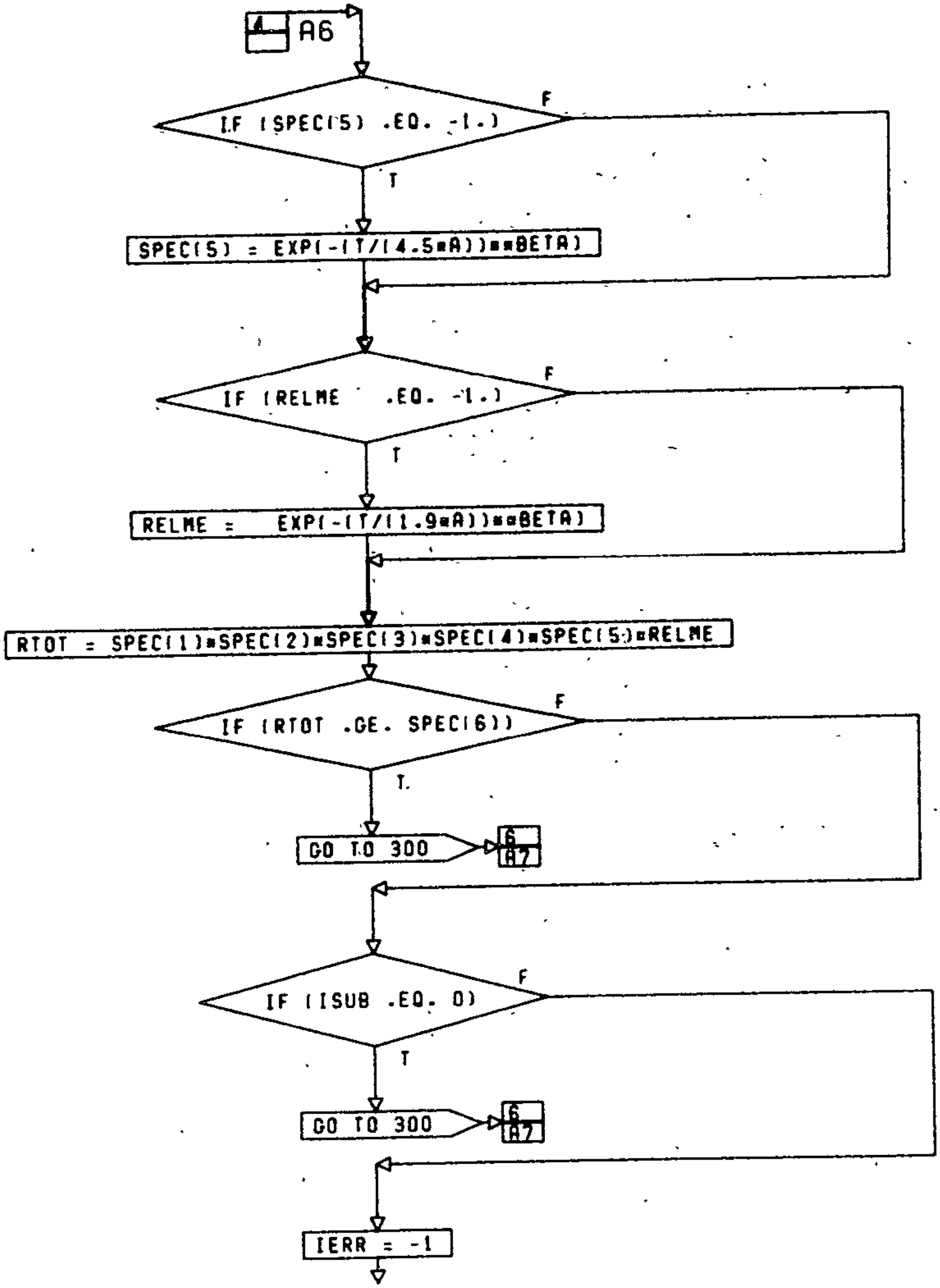
CONT. ON PG 3


2
A3
GO TO 200
2
A4
110
IF (ALT .LT. 500.)
F
T
ORBINC = 35.
IF (ALT .GE. 500. .AND. ALT .LE. 19000.)
F
T
ORBINC = 80.
IF (ALT .GT. 19000.)
F
T
ORBINC = 0.0
C **
C ** THE FOLLOWING AREA PRESETS RELIABILITY CONSTANTS **
C **
2
A5
200
CONTINUE
BETA = 1.6
B = 1./BETA
RS1 = T/((-ALOG(SPEC(6)))**B)
RS2 = SPEC1/0.88
A = AMAX1(RS1,RS2)

CONT. ON PG 4

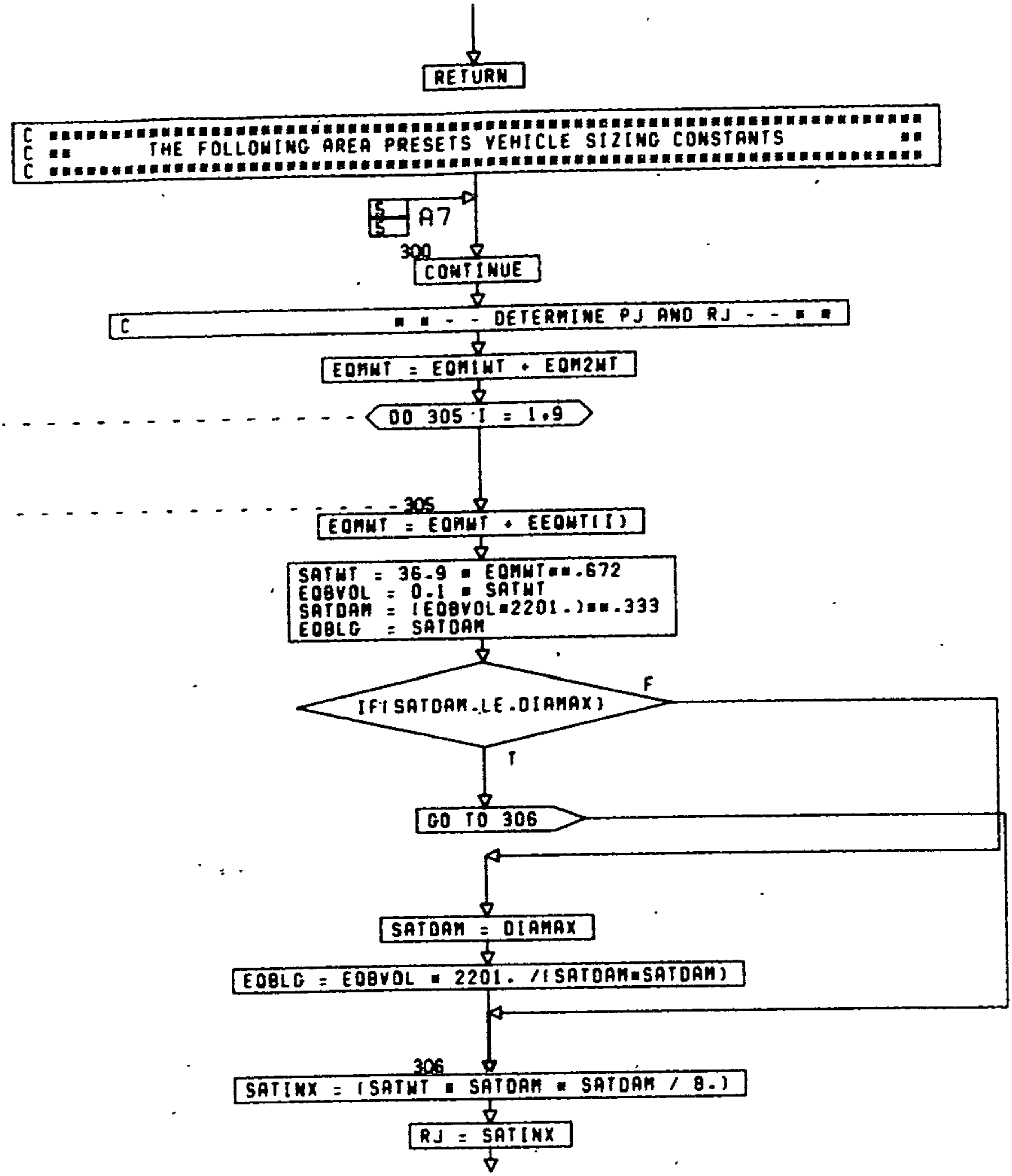

IF (SPEC(1) .EQ. -1.)
F
T
SPEC(1) = EXP(-(T/(3.0*A))**BETA)
IF (SPEC(2) .EQ. -1.)
F
T
SPEC(2) = EXP(-(T/(5.3*A))**BETA)
IF (SPEC(3) .EQ. -1.)
F
T
SPEC(3) = EXP(-(T/(3.3*A))**BETA)
IF (SPEC(4) .EQ. -1.)
F
5
A6
T
SPEC(4) = EXP(-(T/(3.0*A))**BETA)

CONT. ON PG 5

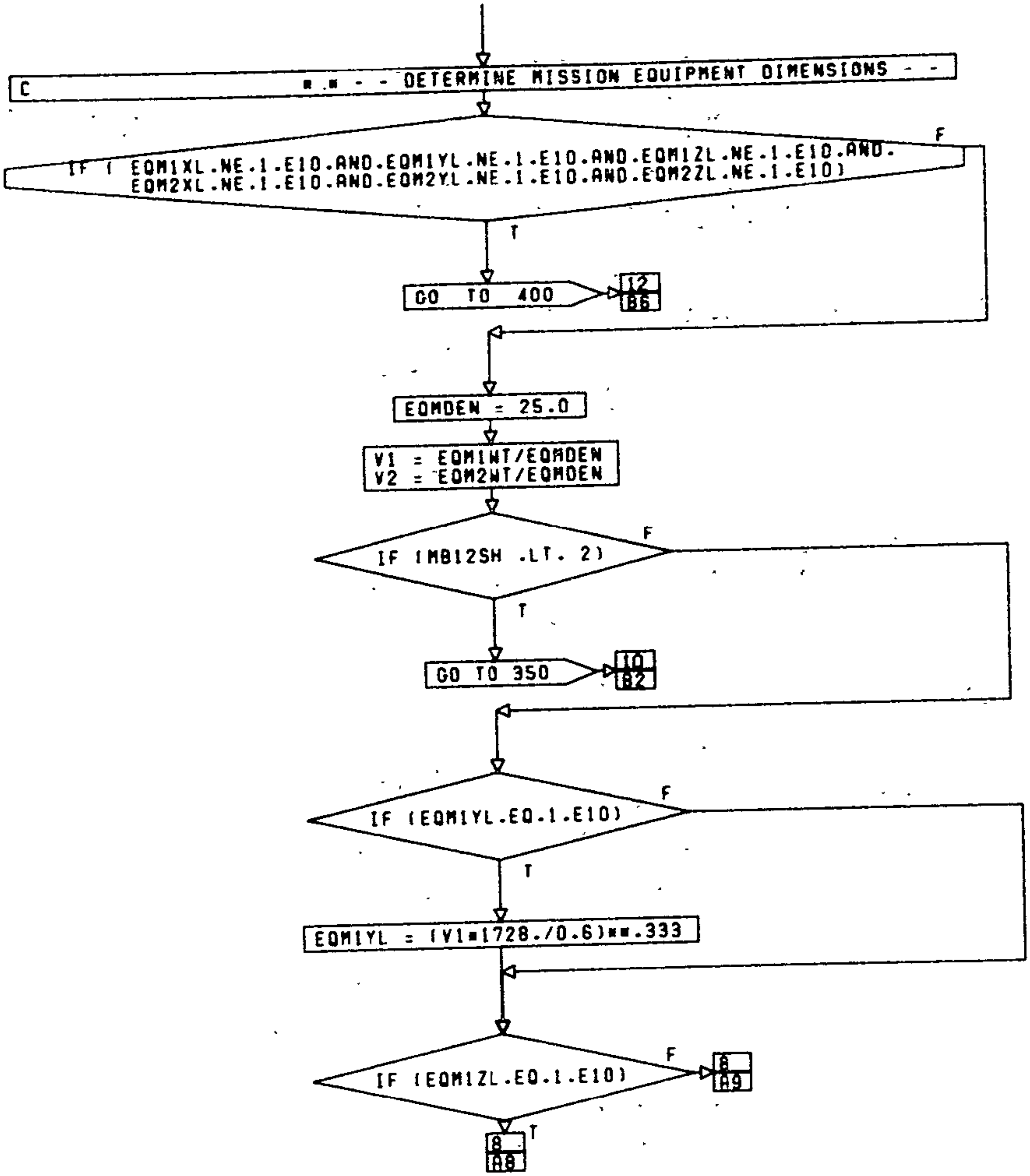


4 A6
IF (SPEC(5) .EQ. -1.)
F
T
SPEC(5) = EXP(-(T/(4.5*A))**BETA)
IF (RELME .EQ. -1.)
F
T
RELME = EXP(-(T/(1.9*A))**BETA)
RTOT = SPEC(1)*SPEC(2)*SPEC(3)*SPEC(4)*SPEC(5)*RELME
IF (RTOT .GE. SPEC(6))
F
T
GO TO 300
6 A7
IF (ISUB .EQ. 0)
F
T
GO TO 300
6 A7
IERR = -1

CONT. ON PG 6

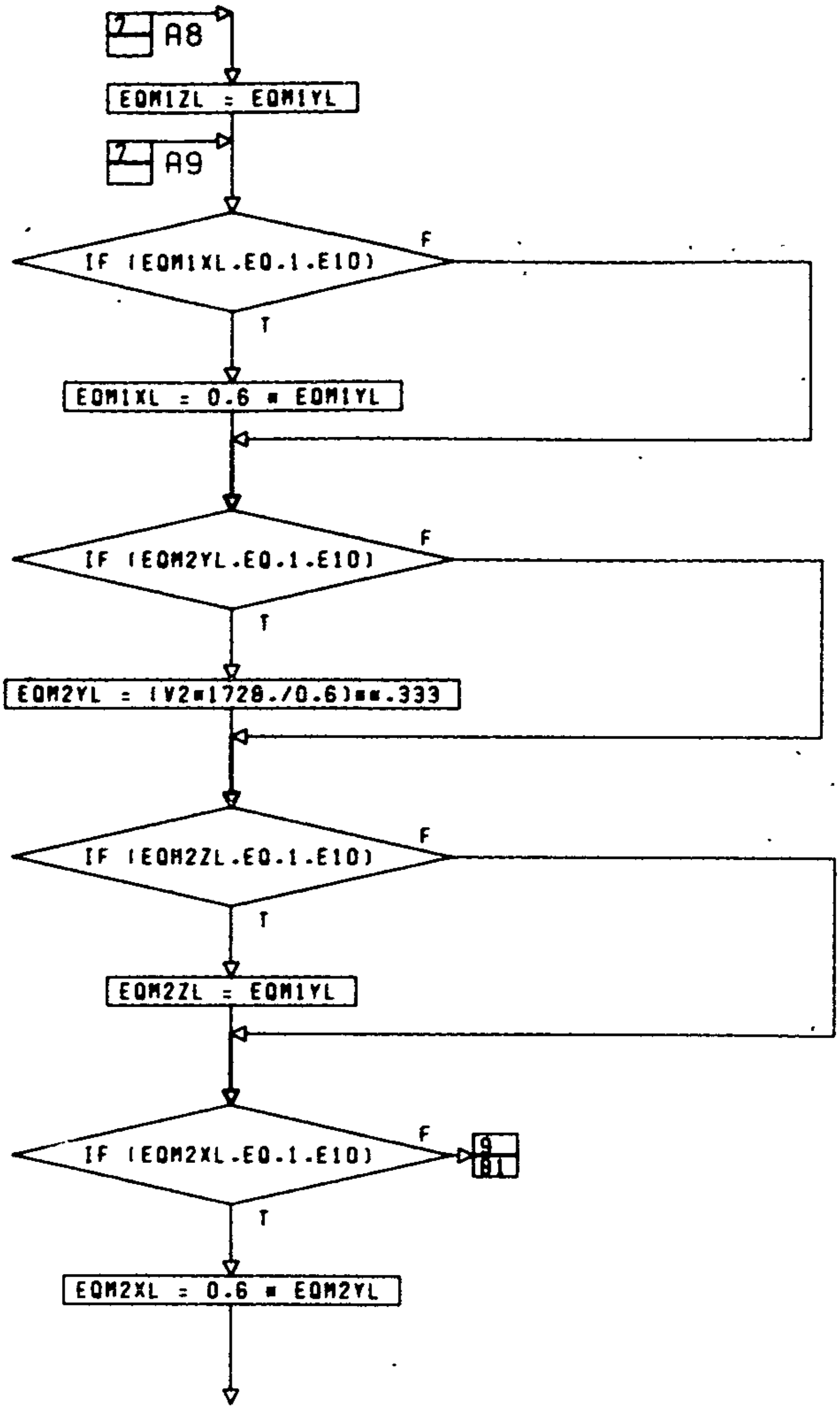

RETURN
C **
C ** THE FOLLOWING AREA PRESETS VEHICLE SIZING CONSTANTS **
C **
A7
300
CONTINUE
C * * - - DETERMINE PJ AND RJ - - * *
EQMWT = EQM1WT + EQM2WT
DO 305 I = 1,9
305
EQMWT = EQMWT + EEQWT(I)
SATWT = 36.9 * EQMWT**.672
EQBVOL = 0.1 * SATWT
SATDAM = (EQBVOL*2201.)**.333
EQBLG = SATDAM
F
IF(SATDAM.LE.DIAMAX)
T
GO TO 306
SATDAM = DIAMAX
EQBLG = EQBVOL * 2201. /(SATDAM*SATDAM)
306
SATINX = (SATWT * SATDAM * SATDAM / 8.)
RJ = SATINX

CONT. ON PG 7

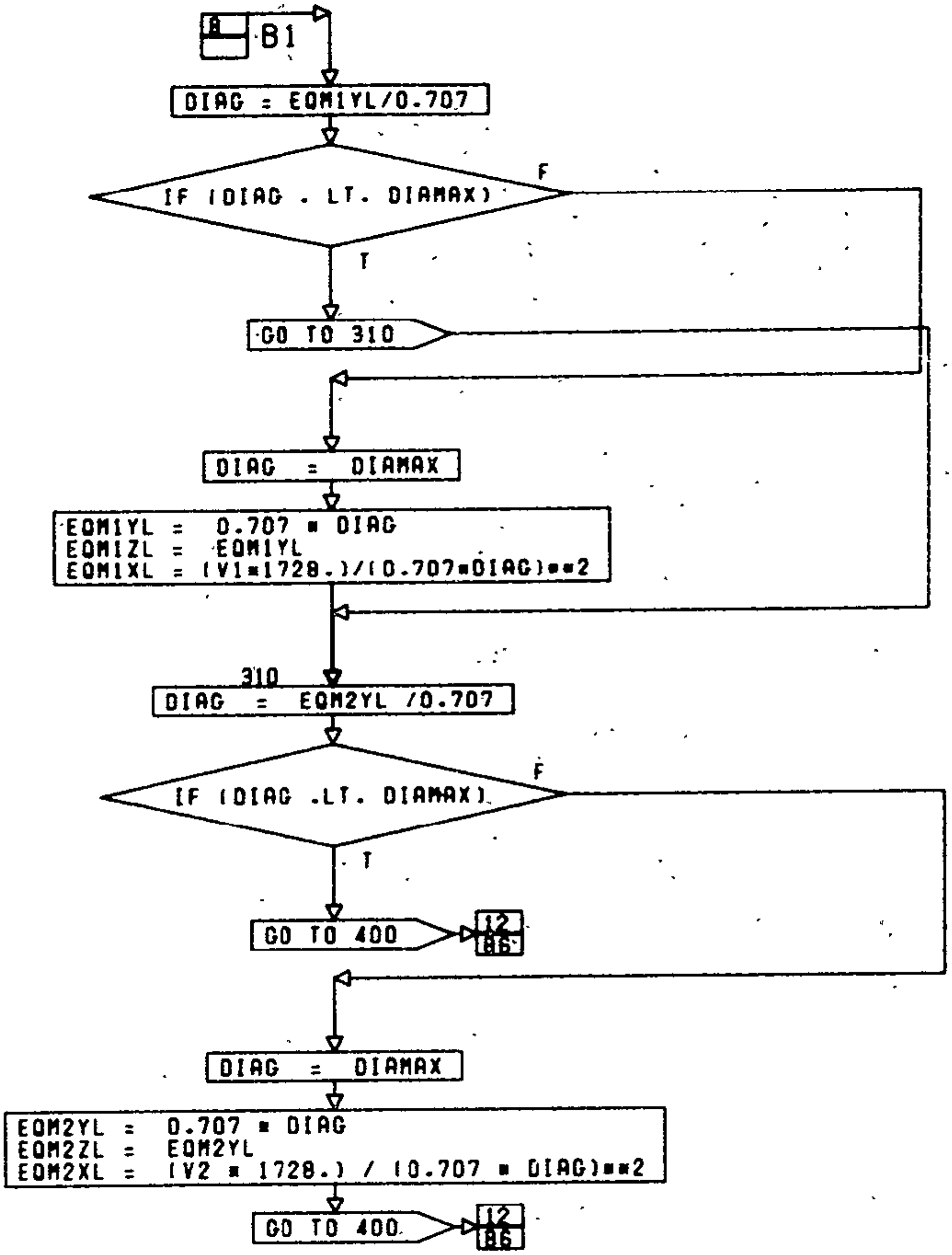


C **.* - - DETERMINE MISSION EQUIPMENT DIMENSIONS - -
IF (EQM1XL.NE.1.E10.AND.EQM1YL.NE.1.E10.AND.EQM1ZL.NE.1.E10.AND.
EQM2XL.NE.1.E10.AND.EQM2YL.NE.1.E10.AND.EQM2ZL.NE.1.E10)
F
T
GO TO 400
12
B6
EQMDEN = 25.0
V1 = EQM1WT/EQMDEN
V2 = EQM2WT/EQMDEN
IF (MB12SH .LT. 2)
F
T
GO TO 350
10
B2
IF (EQM1YL.EQ.1.E10)
F
T
EQM1YL = (V1*1728./0.6)**.333
IF (EQM1ZL.EQ.1.E10)
F
8
A9
T
8
A8

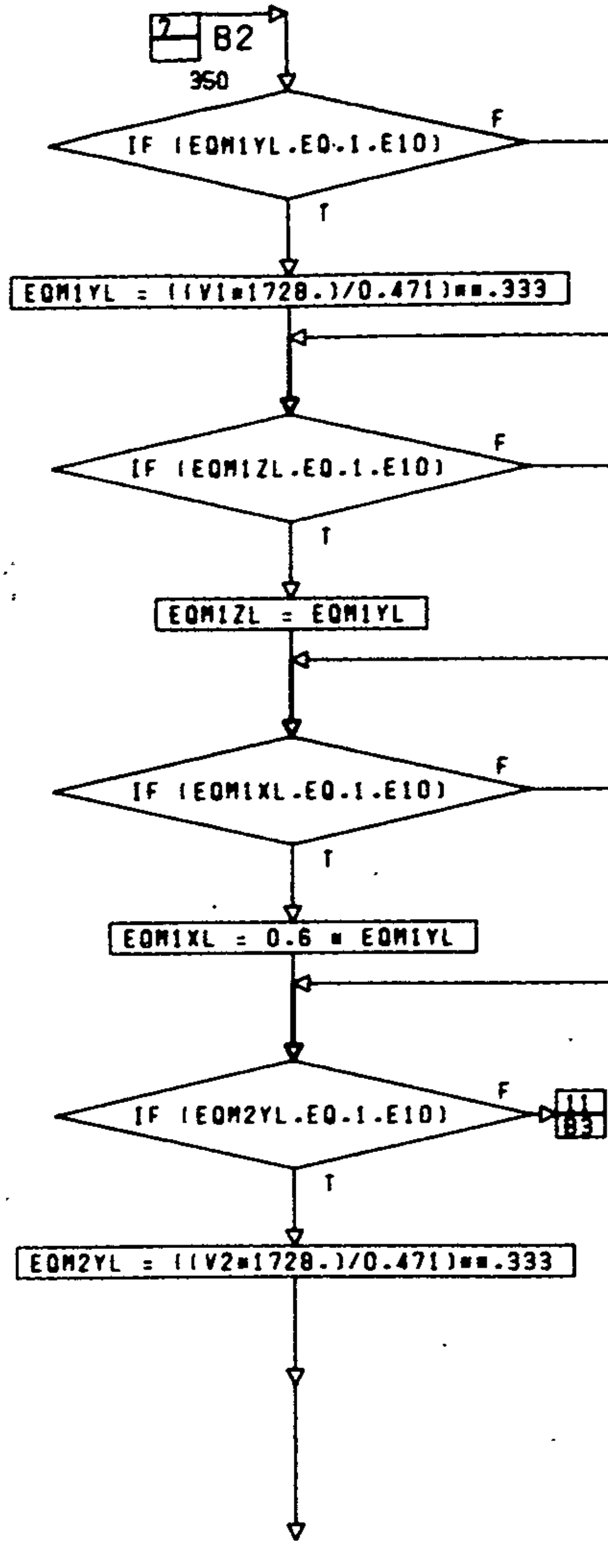
CONT. ON PG 8


7
A8
EQM1ZL = EQM1YL
7
A9
IF (EQM1XL.EQ.1.E10)
F
T
EQM1XL = 0.6 * EQM1YL
IF (EQM2YL.EQ.1.E10)
F
T
EQM2YL = (V2*1728./0.6)**.333
IF (EQM2ZL.EQ.1.E10)
F
T
EQM2ZL = EQM1YL
IF (EQM2XL.EQ.1.E10)
F
9
B1
T
EQM2XL = 0.6 * EQM2YL

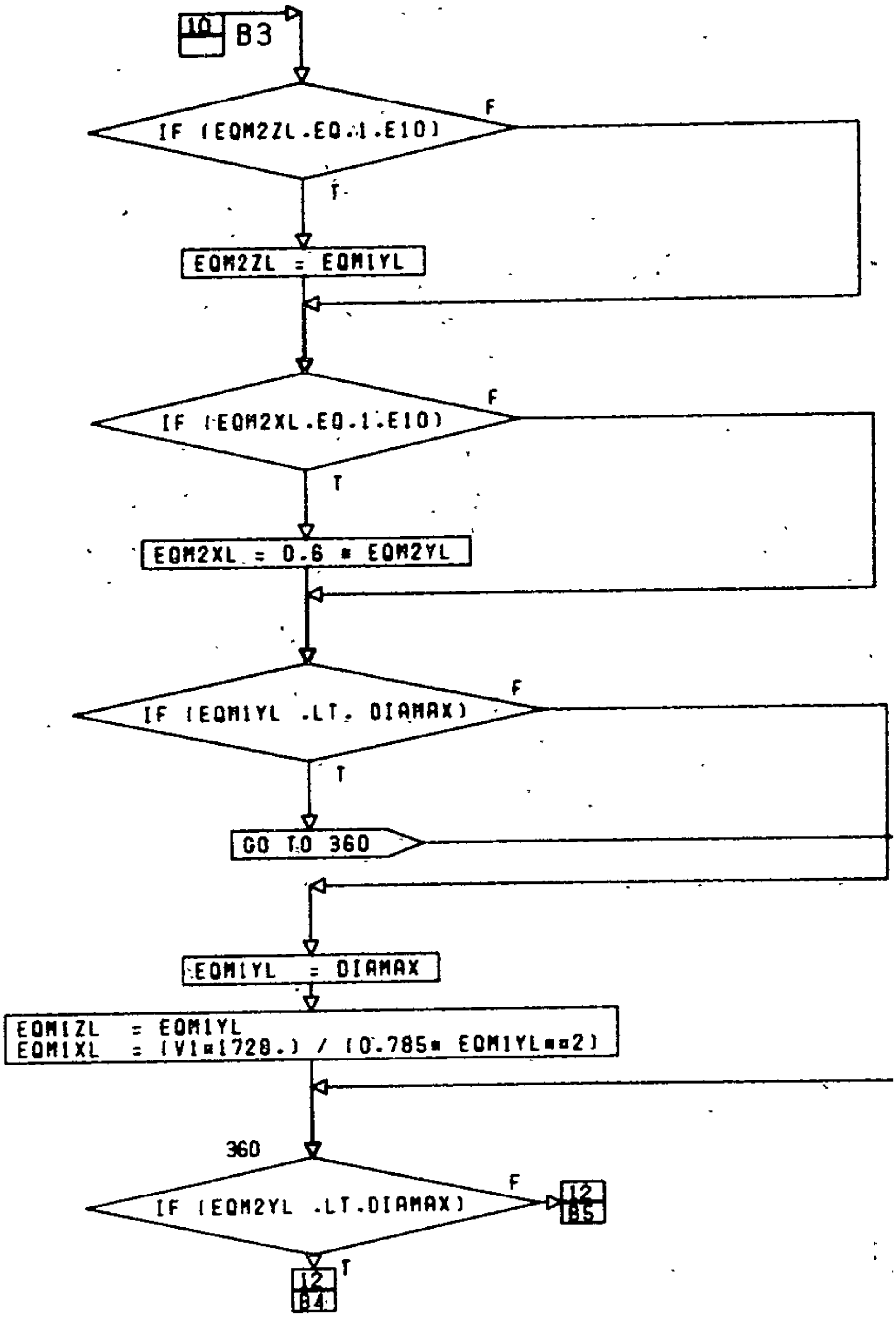
CONT. ON PG 9


B1
DIAG = EQM1YL/0.707
IF (DIAG . LT. DIAMAX)
F
T
GO TO 310
DIAG = DIAMAX
EQM1YL = 0.707 * DIAG
EQM1ZL = EQM1YL
EQM1XL = (V1*1728.)/(0.707*DIAG)**2
310
DIAG = EQM2YL /0.707
IF (DIAG .LT. DIAMAX)
F
T
GO TO 400
12
B6
DIAG = DIAMAX
EQM2YL = 0.707 * DIAG
EQM2ZL = EQM2YL
EQM2XL = (V2 * 1728.) / (0.707 * DIAG)**2
GO TO 400
12
B6

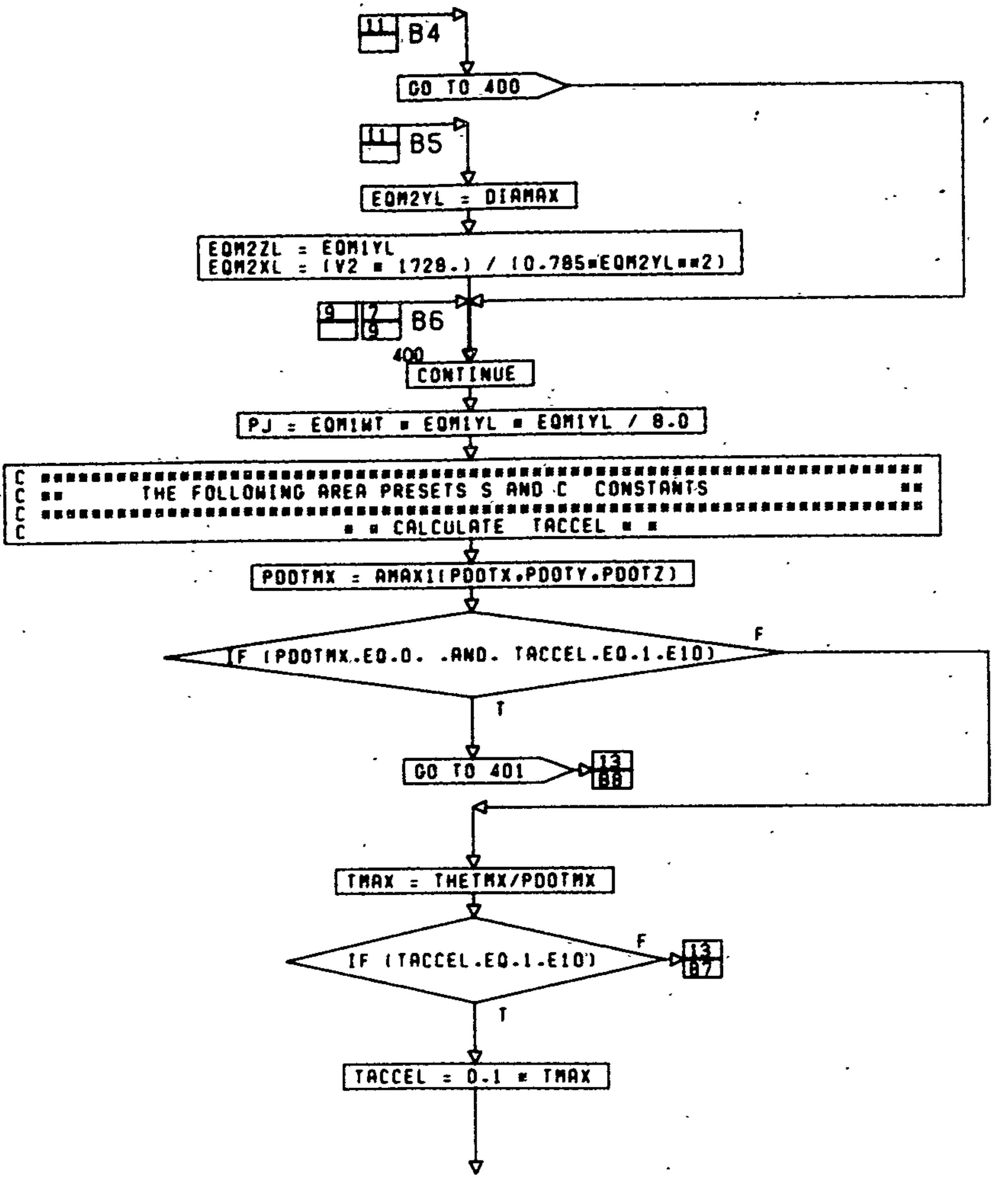
CONT. ON PG 10


B2
350
IF (EQM1YL.EQ.1.E10)
F
T
EQM1YL = ((V1*1728.)/0.471)**.333
IF (EQM1ZL.EQ.1.E10)
F
T
EQM1ZL = EQM1YL
IF (EQM1XL.EQ.1.E10)
F
T
EQM1XL = 0.6 * EQM1YL
IF (EQM2YL.EQ.1.E10)
F
T
11
B3
EQM2YL = ((V2*1728.)/0.471)**.333

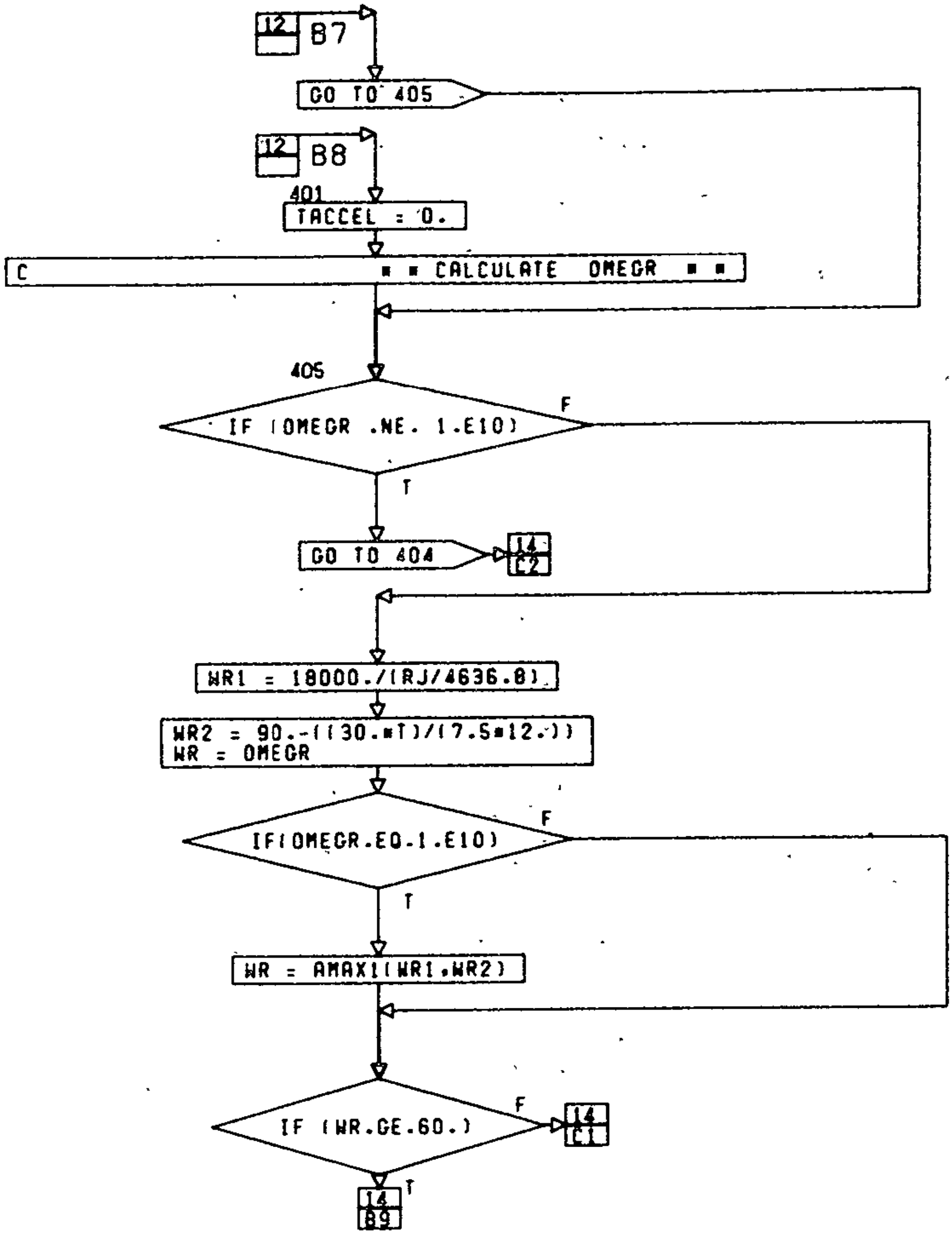
CONT. ON PG 11


10
B3
IF (EQM2ZL.EQ.1.E10)
F
T
EQM2ZL = EQM1YL
IF (EQM2XL.EQ.1.E10)
F
T
EQM2XL = 0.6 * EQM2YL
IF (EQM1YL .LT. DIAMAX)
F
T
GO TO 360
EQM1YL = DIAMAX
EQM1ZL = EQM1YL
EQM1XL = (V1*1728.) / (0.785* EQM1YL**2)
360
IF (EQM2YL .LT.DIAMAX)
F
12
B5
T
12
B4

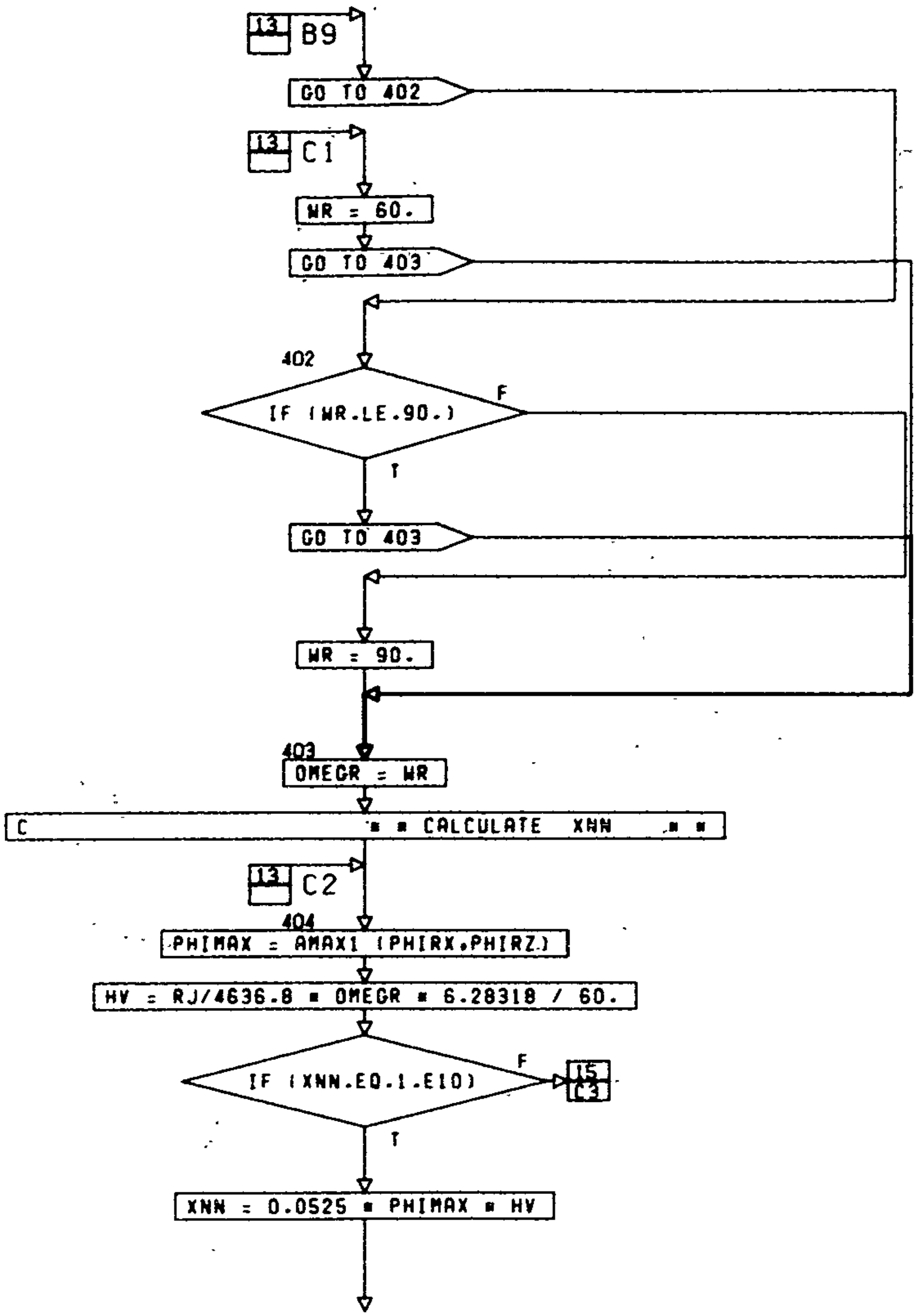
CONT. ON PG 12


11
B4
GO TO 400
11
B5
EQM2YL = DIAMAX
EQM2ZL = EQM1YL
EQM2XL = (V2 * 1728.) / (0.785*EQM2YL**2)
9
7
9
B6
400
CONTINUE
PJ = EQM1WT * EQM1YL * EQM1YL / 8.0
C **
C **   THE FOLLOWING AREA PRESETS S AND C CONSTANTS   **
C **
C   * * CALCULATE TACCEL * *
PDOTMX = AMAX1(PDOTX,PDOTY,PDOTZ)
IF (PDOTMX.EQ.0. .AND. TACCEL.EQ.1.E10)
F
T
GO TO 401
13
B8
TMAX = THETMX/PDOTMX
IF (TACCEL.EQ.1.E10)
F
13
B7
T
TACCEL = 0.1 * TMAX

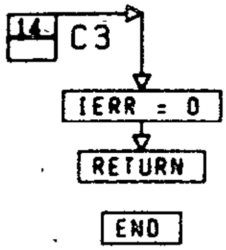
CONT. ON PG 13


12
B7
GO TO 405
12
B8
401
TACCEL = 0.
C * * CALCULATE OMEGR * *
405
IF (OMEGR .NE. 1.E10)
F
T
GO TO 404
14
C2
WR1 = 18000./(RJ/4636.8)
WR2 = 90.-((30.*T)/(7.5*12.))
WR = OMEGR
IF(OMEGR.EQ.1.E10)
F
T
WR = AMAX1(WR1,WR2)
IF (WR.GE.60.)
F
14
C1
T
14
B9

CONT. ON PG 14


13
B9
GO TO 402
13
C1
WR = 60.
GO TO 403
402
IF (WR.LE.90.)
F
T
GO TO 403
WR = 90.
403
OMEGR = WR
C * * CALCULATE XNN * *
13
C2
404
PHIMAX = AMAX1 (PHIRX,PHIRZ)
HV = RJ/4636.8 * OMEGR * 6.28318 / 60.
IF (XNN.EQ.1.E10)
F
15
C3
T
XNN = 0.0525 * PHIMAX * HV

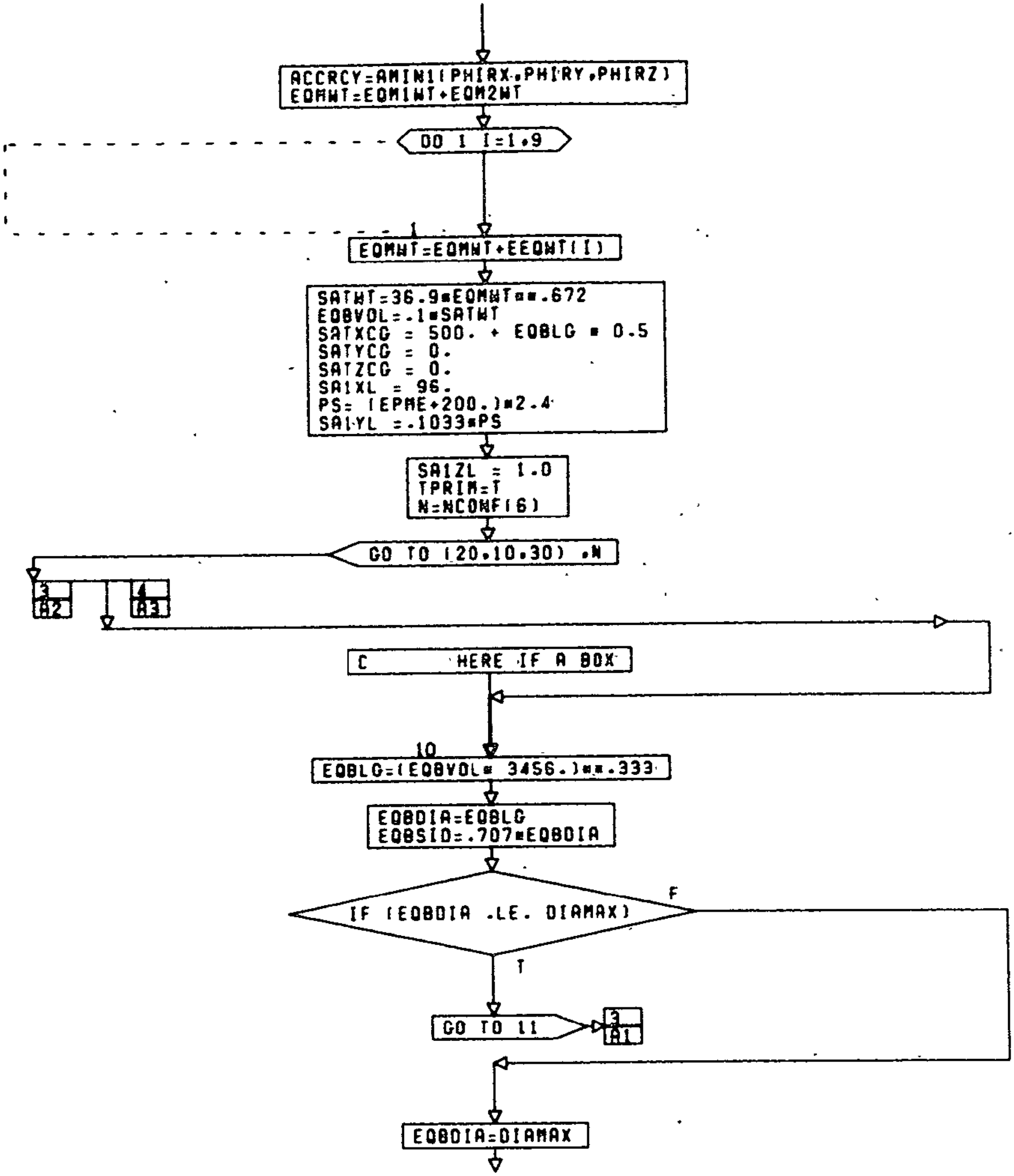
CONT. ON PG 15



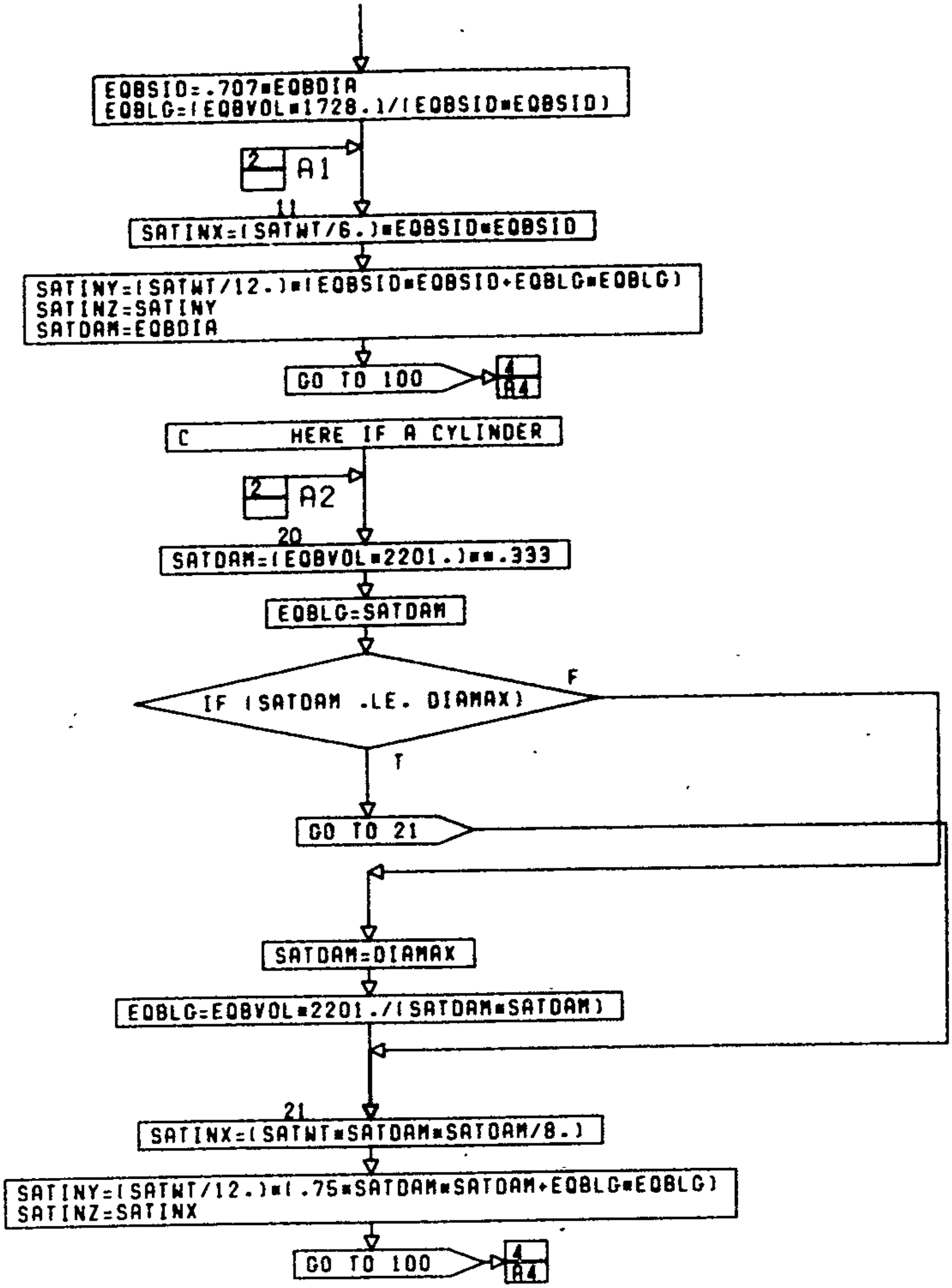
PG 15 FINAL

```
SUBROUTINE INITIL(NCONF,IERR)

C       THIS SUBROUTINE SETS APPROXIMATIONS FOR ALL VALUES IN BTWN
C       WHICH ARE USED BEFORE THEY ARE CALCULATED

DIMENSION NCONF(6)

COMMON /USER1/     ALPHA,      AX,      AY,      AZ,     DPHI,
                      EA,    EANT,     EPI,       K,     MANV,
                   OMEGR,  PDOTAV,  PDOTRX,  PDOTRY,   PDOTRZ,
                  PDOTST,   PDOTX,   PDOTY,   PDOTZ,    PDOTO,
                  PHIFOV,   PHIRX,   PHIRY,   PHIRZ,   TACCEL,
                  THETMX,   THOLD,      TL,   TPMIN,   TSMALL,
                      XN,     XNN,    XNNN,     XNU,       YN,
                      ZN

COMMON /USERI/    APOGEE,  COMRAT,  DIAMAX, EEQWT(9),    EPME,
                  EQM1WT,  EQM1XL,  EQM1YL,  EQM1ZL,   EQM2WT,
                  EQM2XL,  EQM2YL,  EQM2ZL,      FE,   IAGNCY,
        IDEBUG,   ISATOR,  MB12SH,  OPTEMP,  ORBINC,   PERIGE,
         MICRO,    RELME, SPEC(6),   SPEC1,       T,   XCGSAI,
                    XMER,    XMEU

COMMON /BTWN/      ACSSN,   ACSWP,     ALT,    AREA,   BATCAP,
               BITRAT(2),   CLIFE,  CONVWT,       D,       DT,
                      DX,      DY,      DZ,   EQBLG,   EQBSID,
                      FC,      FE,  HARNWT,     HPT,   HTPIPE,
                    HTPT,  HTRPRB,  HTRPWR,            IBTLOC,
                   LMBDD,      NC,   OMEGS,  PASSTR,       PJ,
                      PL,   PLMIN,  POCNWT,    RADA,    RADAB,
                     RAT,      RJ,  SABOLG,   SATLG,   SATTWT,

                   SATWT,  SATXCG,  SATYCG,  SATZCG,   SA1XL,
                   SA1YL,   SA1ZL,    SIDE,   SYSLB,   THCMWT,
               THRUST(2),      TI,   TNKWT,   TPRIM,       VB,
                    VCHP,     VOL,    WATE,      WB,      WBT,
                      WT,      XJ,  XNZERO,      YJ,       ZJ

COMMON/PRTCOM/    ACCRCY,      AM,      AN,      BF,       BS,
              CDPI(7,2),   CISTAR,    CTOT,    DDTE,       DE,
                  DRIWT,   EQBSTR,  FEEINV,  FEEOPS,     FEER,
                    GSE,     IREL,  ITRUNC,  MMDOLD,NAME(3,60),
                    OPS,   PAYINV,  PAYQUL,    PAYR,       PE,
                    PMP,      PMR, POWER(6),     PU,  PWR(60),
                    QCP,      QCR, ROLD(60), SABMWT,   SATADP,
                 SATINV,     SATR,    SEIP,    SEIR, SKTAU(6),

              SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7),
                     TA, TAU(6,6),      TB,      TC,       TE,
                     TF,    TOOLR,   TOOLU,  TOTOPS,    TRUNC,
                     TS,  TTT,VOLUME(6), VOL(60),WEIGHT(6),
                 XLTOT,      XMEH,  XMEINV,    XMEL,    XMEVL,
                  XMEW,     XMEWT,   XVEST

IERR=0
```

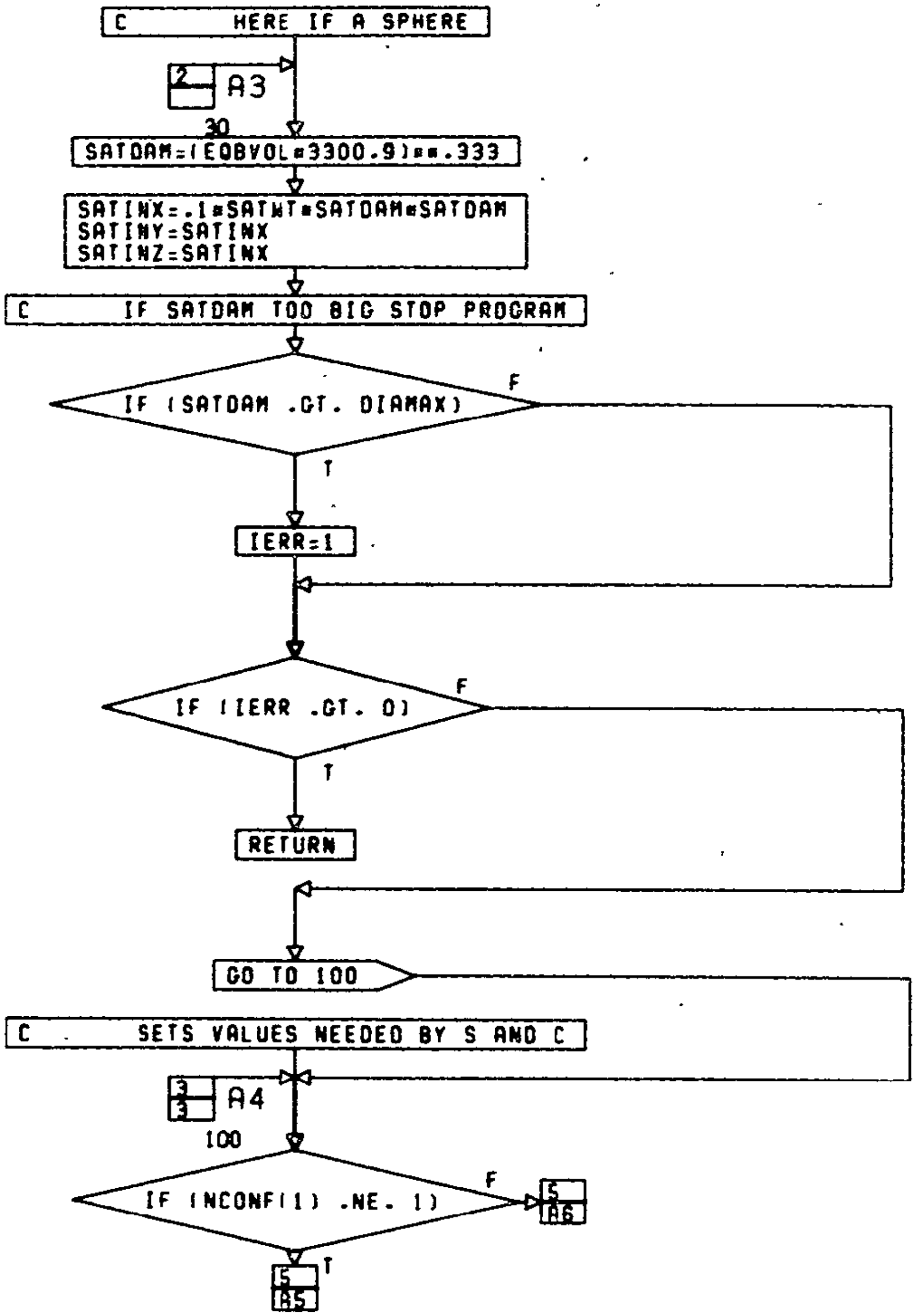
CONT. ON PG 2


ACCRCY=AMIN1(PHIRX,PHIRY,PHIRZ)
EQMWT=EQM1WT+EQM2WT
DO 1 I=1,9
1
EQMWT=EQMWT+EEQWT(I)
SATWT=36.9*EQMWT**.672
EQBVOL=.1*SATWT
SATXCG = 500. + EQBLG * 0.5
SATYCG = 0.
SATZCG = 0.
SAIXL = 96.
PS= (EPME+200.)*2.4
SAIYL =.1033*PS
SAIZL = 1.0
TPRIM=T
N=NCONF(6)
GO TO (20,10,30) ,N
3 A2
4 A3
C HERE IF A BOX
10
EQBLG=(EQBVOL* 3456.)**.333
EQBDIA=EQBLG
EQBSID=.707*EQBDIA
IF (EQBDIA .LE. DIAMAX)
F
T
GO TO 11
3 A1
EQBDIA=DIAMAX

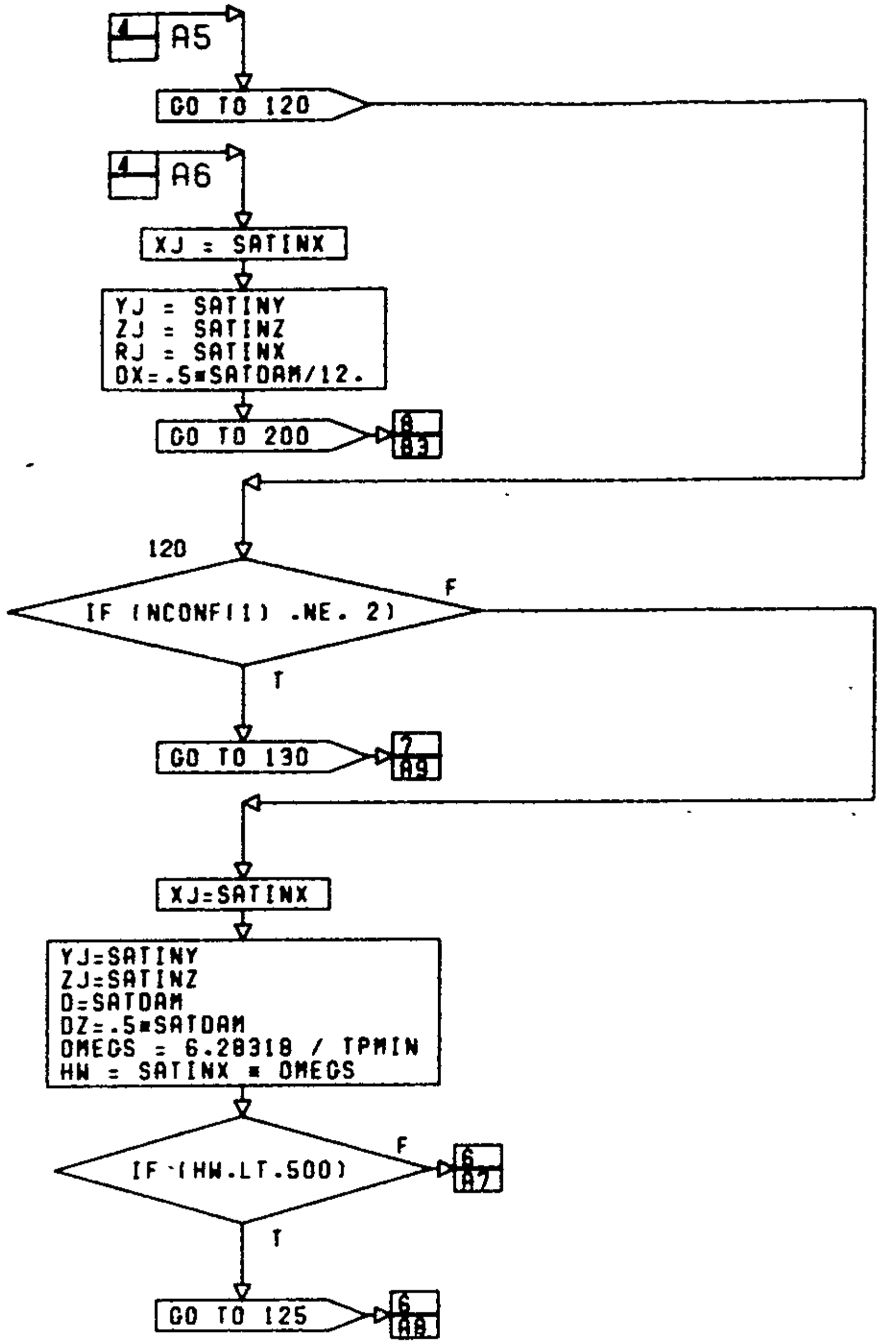
CONT. ON PG 3


EQBSID=.707*EQBDIA
EQBLG=(EQBVOL*1728.)/(EQBSID*EQBSID)
2
A1
11
SATINX=(SATWT/6.)*EQBSID*EQBSID
SATINY=(SATWT/12.)*(EQBSID*EQBSID+EQBLG*EQBLG)
SATINZ=SATINY
SATDAM=EQBDIA
GO TO 100
4
A4
C HERE IF A CYLINDER
2
A2
20
SATDAM=(EQBVOL*2201.)**.333
EQBLG=SATDAM
IF (SATDAM .LE. DIAMAX)
F
T
GO TO 21
SATDAM=DIAMAX
EQBLG=EQBVOL*2201./(SATDAM*SATDAM)
21
SATINX=(SATWT*SATDAM*SATDAM/8.)
SATINY=(SATWT/12.)*(.75*SATDAM*SATDAM+EQBLG*EQBLG)
SATINZ=SATINX
GO TO 100
4
A4

CONT. ON PG 4

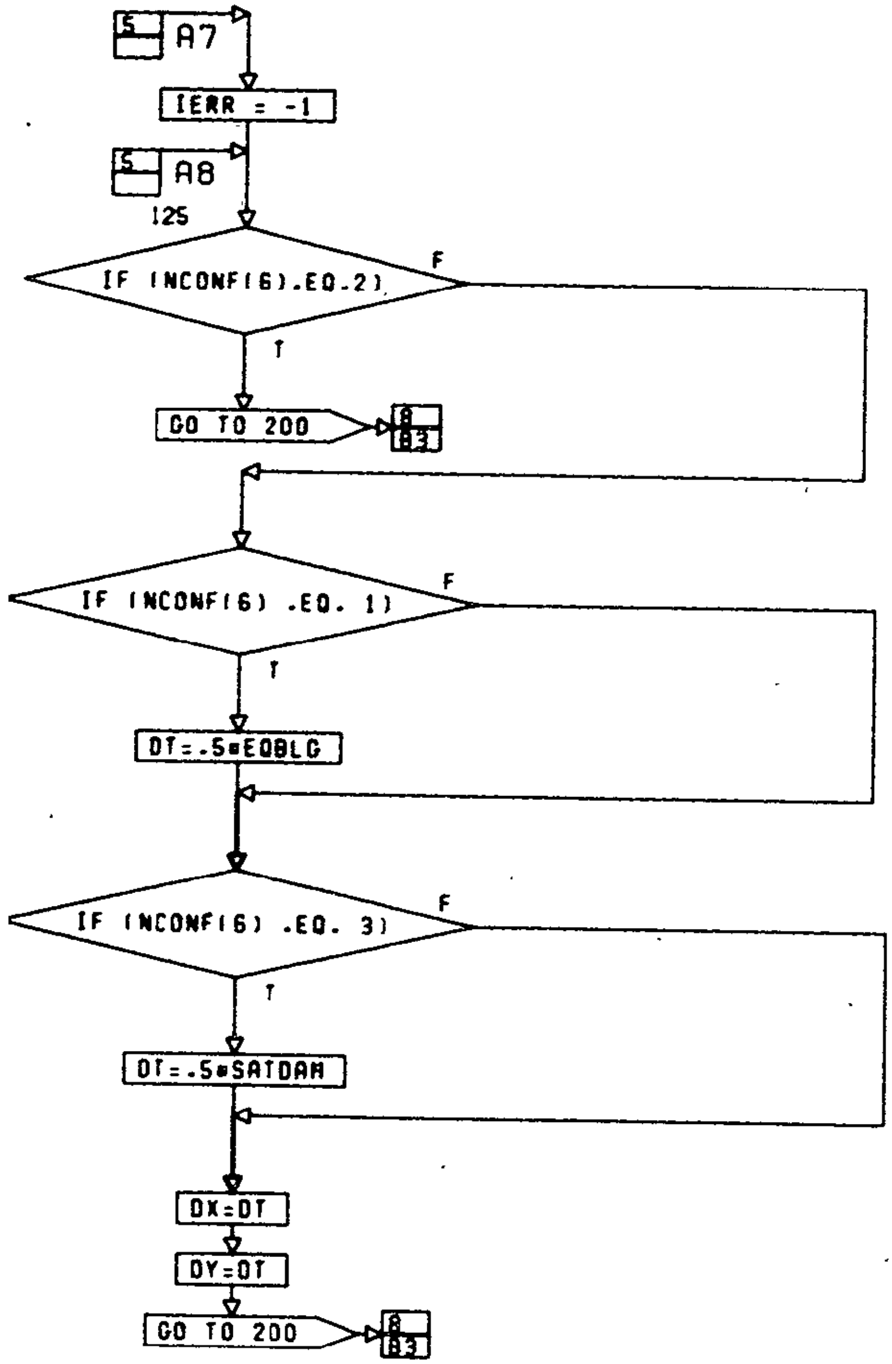

C HERE IF A SPHERE
2
A3
30
SATDAM=(EQBVOL*3300.9)**.333
SATINX=.1*SATWT*SATDAM*SATDAM
SATINY=SATINX
SATINZ=SATINX
C IF SATDAM TOO BIG STOP PROGRAM
IF (SATDAM .GT. DIAMAX)
F
T
IERR=1
IF (IERR .GT. 0)
F
T
RETURN
GO TO 100
C SETS VALUES NEEDED BY S AND C
3
3
A4
100
IF (NCONF(1) .NE. 1)
F
5
A6
T
5
A5

CONT. ON PG 5

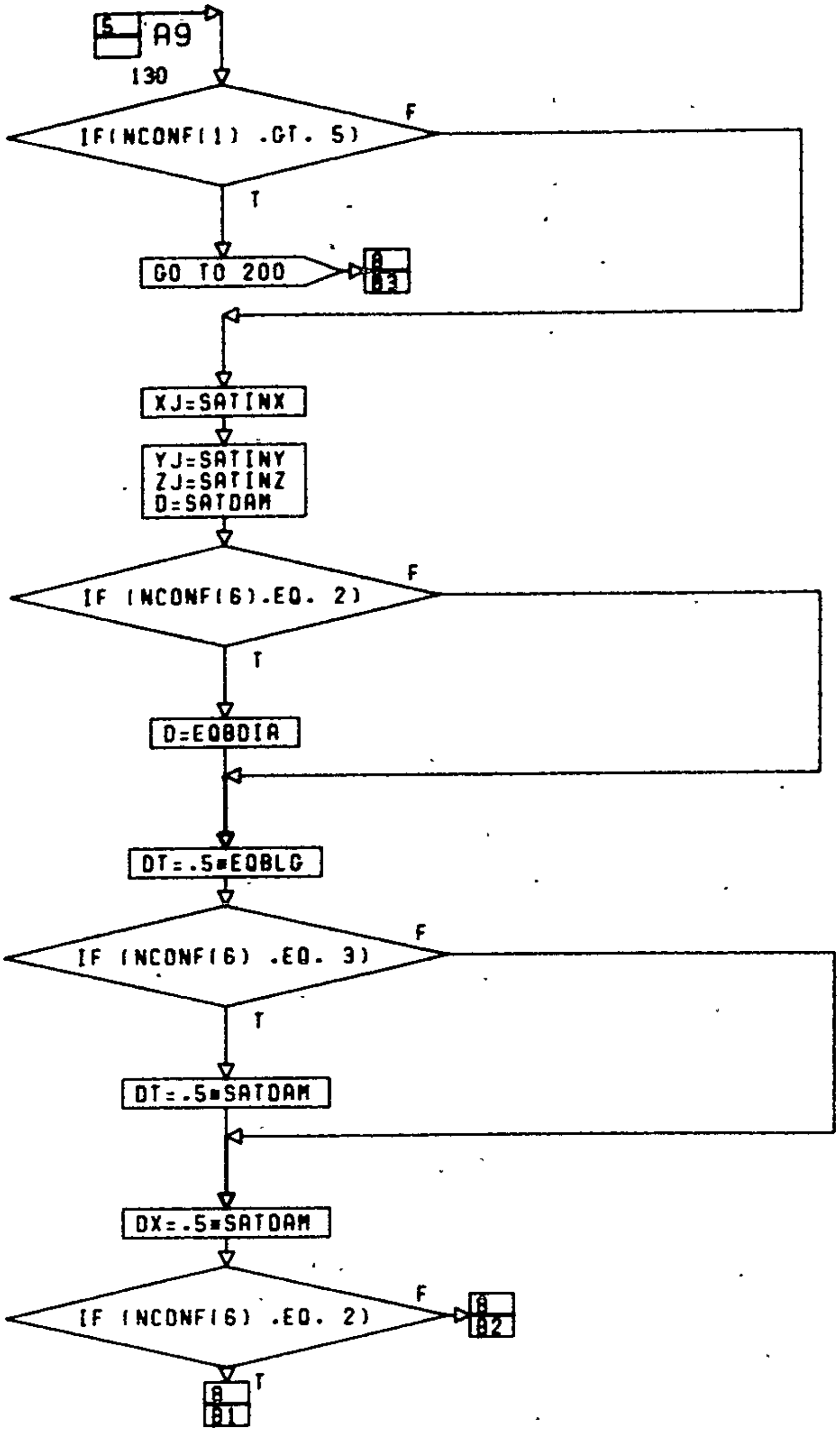


4
A5
GO TO 120
4
A6
XJ = SATINX
YJ = SATINY
ZJ = SATINZ
RJ = SATINX
DX=.5*SATDAM/12.
GO TO 200
8
B3
120
IF (NCONF(1) .NE. 2)
F
T
GO TO 130
7
A9
XJ=SATINX
YJ=SATINY
ZJ=SATINZ
D=SATDAM
DZ=.5*SATDAM
OMEGS = 6.28318 / TPMIN
HW = SATINX * OMEGS
IF (HW.LT.500)
F
6
A7
T
GO TO 125
6
A8

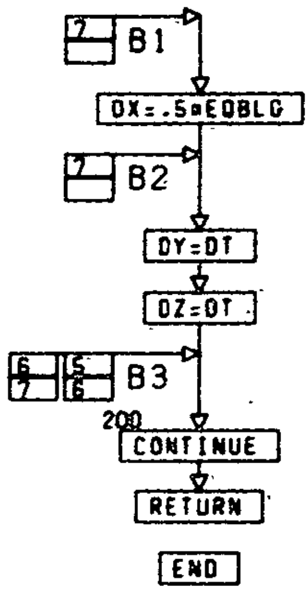
CONT. ON PG 6


5
A7
IERR = -1
5
A8
125
IF (NCONF(6).EQ.2)
F
T
GO TO 200
8
B3
IF (NCONF(6) .EQ. 1)
F
T
DT=.5*EQBLG
IF (NCONF(6) .EQ. 3)
F
T
DT=.5*SATDAM
DX=DT
DY=DT
GO TO 200
8
B3

CONT. ON PG 7


5
A9
130
IF(NCONF(1) .GT. 5)
F
T
GO TO 200
A
B3
XJ=SATINX
YJ=SATINY
ZJ=SATINZ
D=SATDAM
IF (NCONF(6).EQ. 2)
F
T
D=EQBDIA
DT=.5*EQBLG
IF (NCONF(6) .EQ. 3)
F
T
DT=.5*SATDAM
DX=.5*SATDAM
IF (NCONF(6) .EQ. 2)
F
A
B2
T
A
B1

CONT. ON PG 8



PG 8 FINAL

```
BLOCK DATA

C         SETS ALL DEFAULT VALUES

COMMON /USER1/     ALPHA,      AX,       AY,       AZ,      DPHI,
                      EA,     EANT,      EPI,        K,      MANV,
                  OMEGR,   PDOTAV,   PDOTRX,   PDOTRY,    PDOTRZ,
                 PDOTST,    PDOTX,    PDOTY,    PDOTZ,     PDOTO,
                 PHIFOV,    PHIRX,    PHIRY,    PHIRZ,    TACCEL,
                 THETMX,    THOLD,       TL,    TPMIN,    TSMALL,
                     XN,      XNN,     XNNN,      XNU,        YN,
                     ZN

COMMON /USER3/ARRAYN(11,3), BTRMX,    NMSEQ,    OPSMS,     SCSFL,
                  TPRFL

COMMON /USER4/BWIDTH(2),  FREQ(2),    FREQR,IOPTCM(3),      LINK,
                  NADIR,      NET

COMMON /USER6/ CGEEX(9), EELOC(9), EEQVL(9),   EM1YCG,    EM1ZCG,
            EQPF,  EM2YCG,   EM2ZCG,   ISBOFG,   NUMEEQ,    XCGSA3

COMMON /USER8/SKDME(7,3)
COMMON /USER9/           CA,         CE

COMMON /USERI/    APOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME,
                  EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT,
                  EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY,
          IDEBUG,  ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE,
           MICRO,   RELME,  SPEC(6),    SPECI,        T,   XCGSA1,
                    XMER,     XMEU

COMMON /USERC/    FEEPCT,   IMETYP,      NFV,      NOV,       PI
COMMON /USERR/      ISPT,     ISUB,    KEOPT,   RFIXED,    SLBMX

COMMON /BTWN/      ACSSN,    ACSWP,      ALT,     AREA,   BATCAP,
               BITRAT(2),    CLIFE,   CONVWT,        D,       DT,
                      DX,       DY,       DZ,    EQBLG,   EQBSID,
                      FC,       FF,   HARNWT,      HPT,   HTPIPE,
                    HTPT,   HTRPRB,   HTRPWR,             IBTLOC,
                   LMBDD,       NC,    OMEGS,   PASSTR,       PJ,
                      PL,    PLMIN,   POCNWT,     RADA,    RADAB,
                     RAT,       RJ,   SABOLG,    SATLG,   SATTWT,

                   SATWT,   SATXCG,   SATYCG,   SATZCG,   SA1XL,
                   SA1YL,   SA1ZL,      SIDE,   SYSLB,   THCMWT,
               THRUST(2),       TI,   TNKWT,    TPRIM,       VB,
                    VCHP,      VOL,    WATE,       WB,      WBT,
                      WT,       XJ,  XNZERO,       YJ,       ZJ

DATA DPHI,FE,TSMALL,XNU,PDOTO,T/.25,4.1,100.,3.,1.,24./

DATA PHIRX,PHIRY,PHIRZ,PDOTX,PDOTY,PDOTZ,XN,YN,ZN,PDOTRX,PDOTRY,
```

CONT. ON PG 2

```
PDOTRZ/3*.75,6*1.,3*.012/

DATA OMEGS,OMEGR,PJ,XNN,K,MANV /1.5708,1.E10,75.,1.E10,1,1/
DATA EP1,AX,AY,AZ/.0001,3*.05/
DATA THETMX,TPMIN /180.,10./

DATA EA,EANT,ALPHA,TL,TACCEL,XNNN,THOLD,PDOTAV,PDOTST,PHIFOV
 /.1,.1,12.,1.,1.E10,4.,100000.,.01,.0667,40./

DATA CLIFE/50000./
DATA MICRO,IAGNCY /0,1/

DATA BTRMX,SCSFL,TPRFL,DPSMS,ARRAYN,NMSEQ/1024000.,36*0.,
 0/

DATA IVOLT,DPTEMP,EPME /0,15.,200./

DATA IOPTCM,LINK,FREQ,NET,NADIR,FREQR,COMRAT,BWIDTH
      /3*0,1,2*2250.,2*0,1800.,1000.,2*-1.E10/

DATA EQPF,MB12SH,EQM1XL,EQM1YL,EQM1ZL,EQM2XL,EQM2YL /4.95,1,
 5*1.E10/

DATA EQM2ZL,ISBOFG,NUMEEQ,EEQWT,EEQVL,EM1YCG,EM1ZCG,EM2YCG
 /1.E10,2*0,21*0./

DATA EM2ZCG,COEEX,EELOC,XCGSA1,XCGSA3 /0.,9*2.,9*3.,2*1./
DATA ISATOR,ORBINC,IAGNCY/1,-360.,1/
DATA SKOME/21*0./
DATA CA,CE/10.,5./

DATA EQM1WT,EQM2WT,DIAMAX,APOGEE,PERIGE,MICRO/2*435.,120.,2*500.,
    0/

DATA KEOPT,RFIXED,SLBMX,ISPT,SPEC,SPEC1,ISUB,RELME / 1,
 1.,50000.,0,5*(-1.),0.6,18.,0,-1./

DATA NFV,NOV,XMER,XMEU,FEEPCT,IMETYP,PI /4,1,0.,0.,0.07,2,1./

END
```

PG 2 FINAL

```
SUBROUTINE COSTS (NCONF,NEQUIP)
```

```
C *******************************************************************
C **  THIS SUBROUTINE COLLECTS COSTS FOR CATALOG ITEMS AND CALCULATES **
C **  COSTS FOR CER ITEMS AND STORES THEM FOR OUTPUTTING             **
C *******************************************************************
```

```
COMMON /USERC/   FEEPCI,    IMETYP,      NFV,      NOV,        PI
```

```
COMMON /USERI/      APOGEE,    COMRAT,    DIAMAX, EEQWT(9),      EPME,
                    EQM1WT,    EQM1XL,    EQM1YL,   EQM1ZL,    EQM2WT,
                    EQM2XL,    EQM2YL,    EQM2ZL,   XDUM1,     IAGNCY,
          IDEBUG,   ISATOR,    MB12SH,    OPTEMP,   ORBINC,    PERIGE,
           MICRO,    RELME,    SPEC(6),    SPEC1,   XDUM2,     XCOSAI,
                      XMER,      XMEU
```

```
COMMON /BTWN/          ACSSN,     ACSWP,        ALT,      AREA,    BATCAP,
                  BITRAT(2),      CLIFE,     CONVWT,         D,        DT,
                         DX,         DY,         DZ,     EQBLG,    EQBSID,
                         FC,         FF,     HARNWT,       HPT,    HTPIPE,
                       HTPT,     HTRPRB,     HTRPWR,               IBTLOC,
                      LMBOD,         NC,     OMEGS,     PASSTR,        PJ,
                         PL,      PLMIN,     POCNWT,      RADA,     RADAB,
                        RAT,         RJ,     SABOLG,     SATLG,    SATTWT,
```

```
                      SATWT,     SATXCG,     SATYCG,    SATZCG,     SA1XL,
                      SA1YL,      SA1ZL,       SIDE,     SYSLB,    THCMWT,
                  THRUST(2),         TI,      TNKWT,     TPRIM,        VB,
                       VCHP,        VOL,       WATE,        WB,       WBT,
                         WT,         XJ,     XNZERO,        YJ,        ZJ
```

```
COMMON /CHOSE/     COST(5,60),        DPIA(11,60),        ICHOSE(60),
                   NCHOSE(60),        REL ( 6,60),        SKD(7,60),
                   THM(4,60)
```

```
COMMON/PRTCOM/   ACCRCY,          AM,          AN,          BF,          BS,
              COPI(7,2),      CISTAR,        CTOT,        DDTE,          DE,
                  DRINT,      EQBSTR,      FEEINV,      FEEOPS,        FEER,
                    GSE,        IREL,      ITRUNC,      MMDOLD,NAME(3,60),
                    OPS,      PAYINV,      PAYQUL,        PAYR,          PE,
                    PMP,         PMR,    POWER(6),          PU,     PWR(60),
                    QCU,         QCR,    ROLD(60),      SABMWT,      SATADP,
                 SATINV,        SATR,        SEIP,        SEIR,   SKTAU(6),
```

```
              SSREL(6),     SUBE(7),     SUBT(7),    SUBUE(7),    SUBUP(7),
                    TA,   TAU(6,6),          TB,          TC,          TE,
                    TF,       TOOLR,       TOOLU,      TOTOPS,       TRUNC,
                    TS,         TTT,VOLUME(6),    VOL(60),WEIGHT(6),
                 XLTOT,        XMEH,      XMEINV,        XMEL,       XMEVL,
                  XMEW,       XMEWT,       XVEST
```

```
DIMENSION      RE(7),RT(7),RP(7),BE(7),BT(7),BP(7),
               X(7),FP(7),FT(7),FE(7),NCONF(7),NEQUIP(5),
```

CONT. ON PG 2

```
COMPR(60),COMPU(60),SUBR(7),
SUBU(7),COMPSE(60),COMPSP(60),
              SUBSP(7),SUBSE(7),MEQUIP(5)
```

```
DATA
            FP        /7*1./,
            FT        /7*1./,
            FE        /7*1./,
            RE        /41500.,3920.,91287.,82800.,129200.,
                      139000.,51383./,
            RT        /34100.,6000.,69338.,48640.,24160.,
                      48900.,87500./,
```

```
            RP        /42678.,2050.,9400.,14870.,14000.,
                      53545.,36660./,
            BE        /.627,.715,.500,.620,.272,.393,.587/,
            BT        /.500,.585,.500,.620,.675,.410,.301/,
            BP        /.444,.745,.566,.738,.668,.263,.182/,
            SF        /1.0/
```

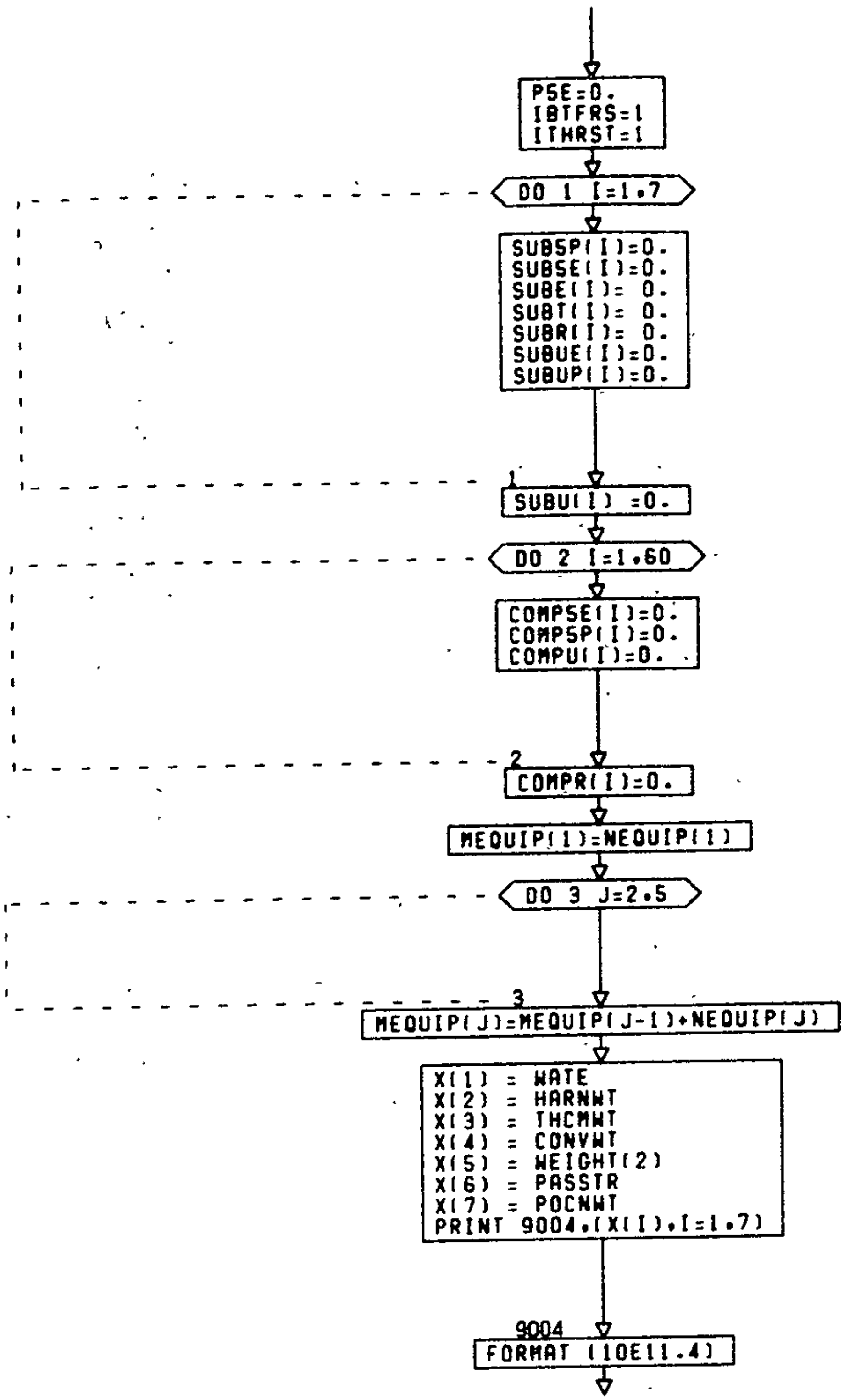
```
SEIR = 0.
QCR = 0.
PMR = 0.
SUMTDE = 0.
TOOLR = 0.
SEIP = 0.
QCU = 0.
PMP = 0.
```

```
SUMPE = 0.
TOTSUM = 0.
SATR = 0.
SATINV = 0.
XMEINV = 0.
PAYR = 0.
PAYINV =0.
PAYOUL = 0.
```

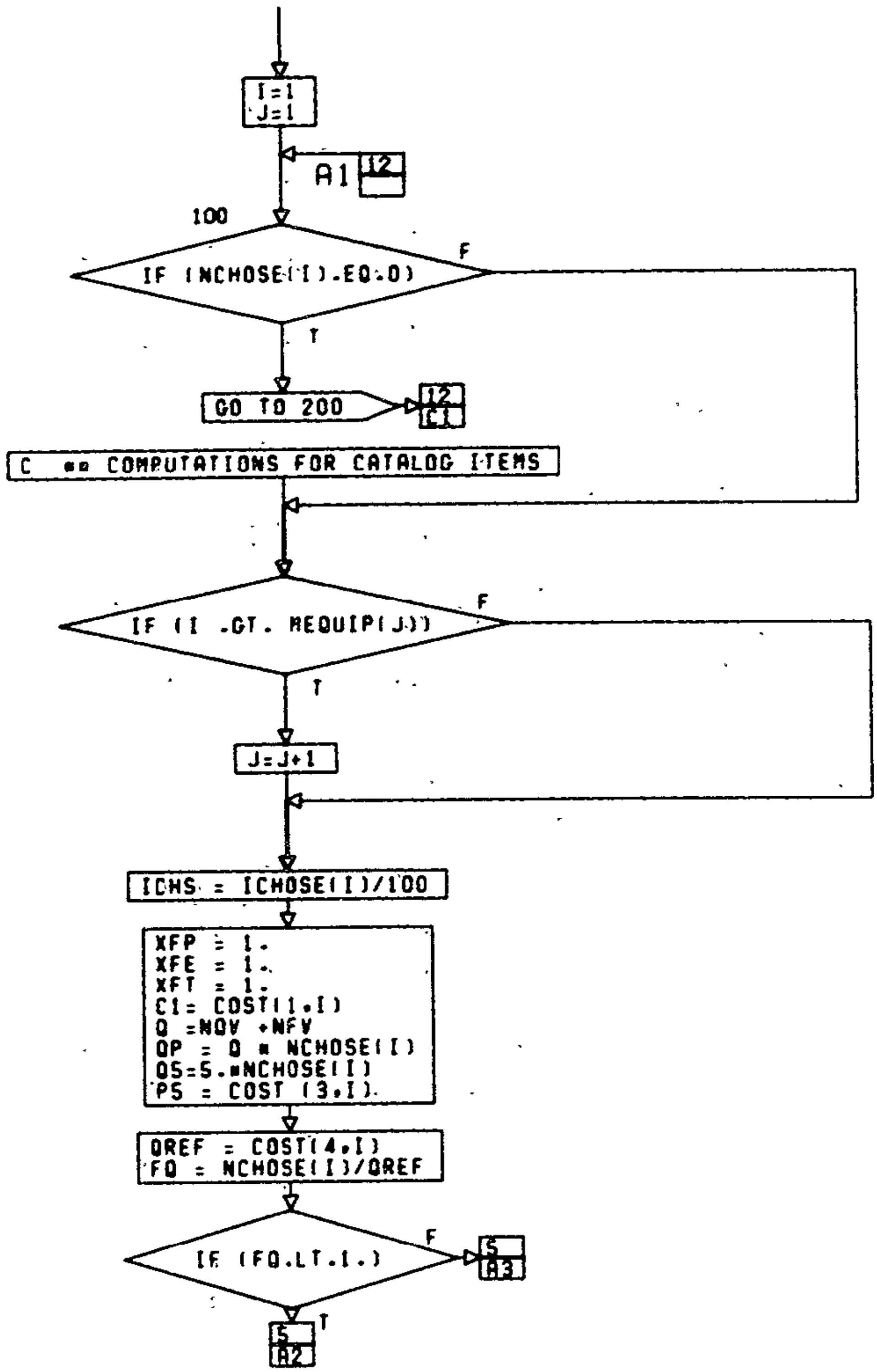
```
QSE   = 0.
XLTOT  = 0.
CTOT   = 0.
FEER   = 0.
FEEINV= 0.
DOTE   = 0.
XVEST  = 0.
OPS    = 0.
```

```
DE = 0.
TE = 0.
PE = 0.
PU = 0.
SYSR=0.
SYSU=0.
QS=0.
PSP=0.
```

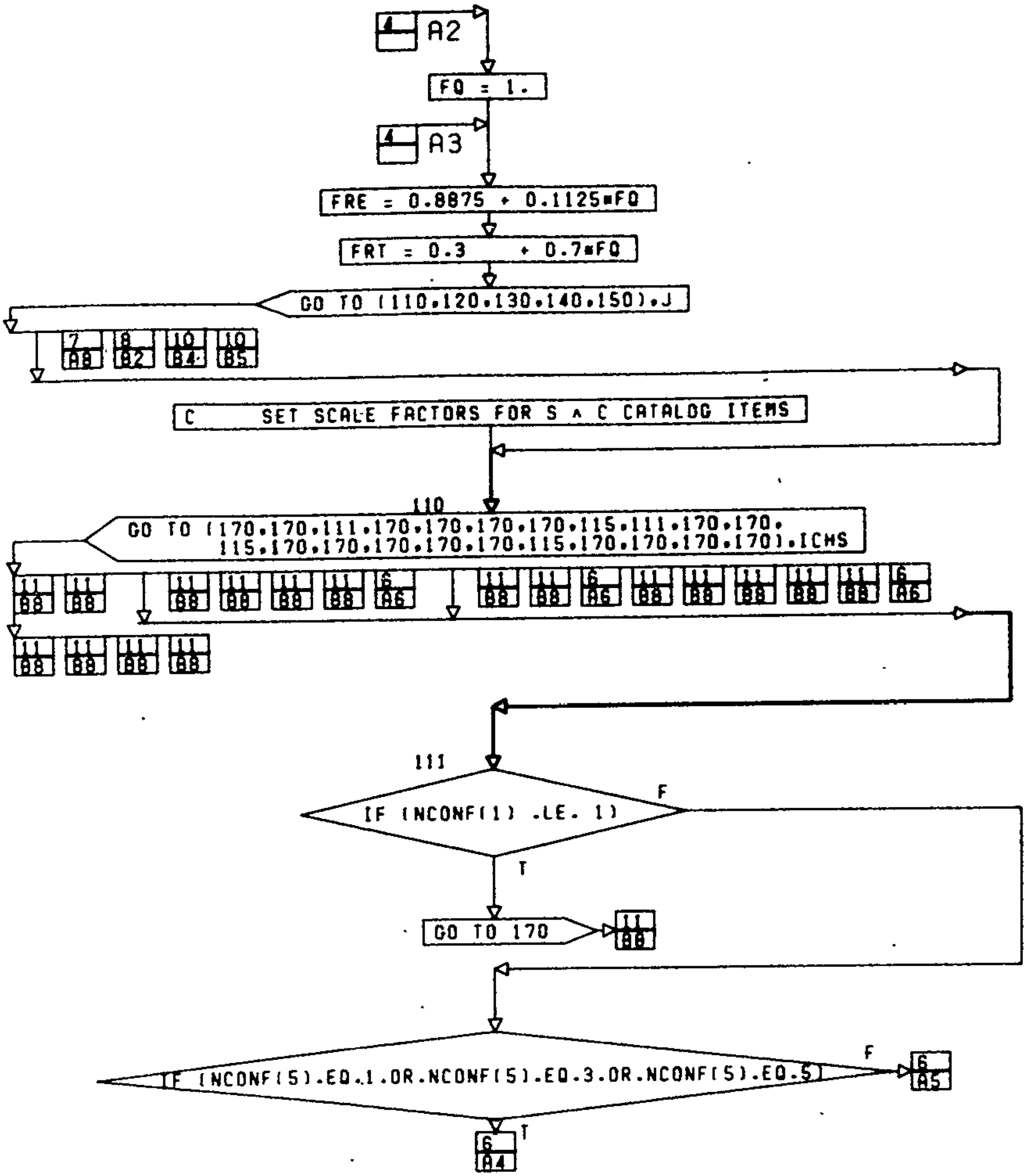
CONT. ON PG 3


PSE=0.
IBTFRS=1
ITHRST=1
DO 1 I=1,7
SUBSP(I)=0.
SUBSE(I)=0.
SUBE(I)= 0.
SUBT(I)= 0.
SUBR(I)= 0.
SUBUE(I)=0.
SUBUP(I)=0.
1
SUBU(I) =0.
DO 2 I=1,60
COMPSE(I)=0.
COMPSP(I)=0.
COMPU(I)=0.
2
COMPR(I)=0.
MEQUIP(1)=NEQUIP(1)
DO 3 J=2,5
3
MEQUIP(J)=MEQUIP(J-1)+NEQUIP(J)
X(1) = WATE
X(2) = HARNWT
X(3) = THCMWT
X(4) = CONVWT
X(5) = WEIGHT(2)
X(6) = PASSTR
X(7) = POCNWT
PRINT 9004,(X(I),I=1,7)
9004
FORMAT (10E11.4)

CONT. ON PG 4

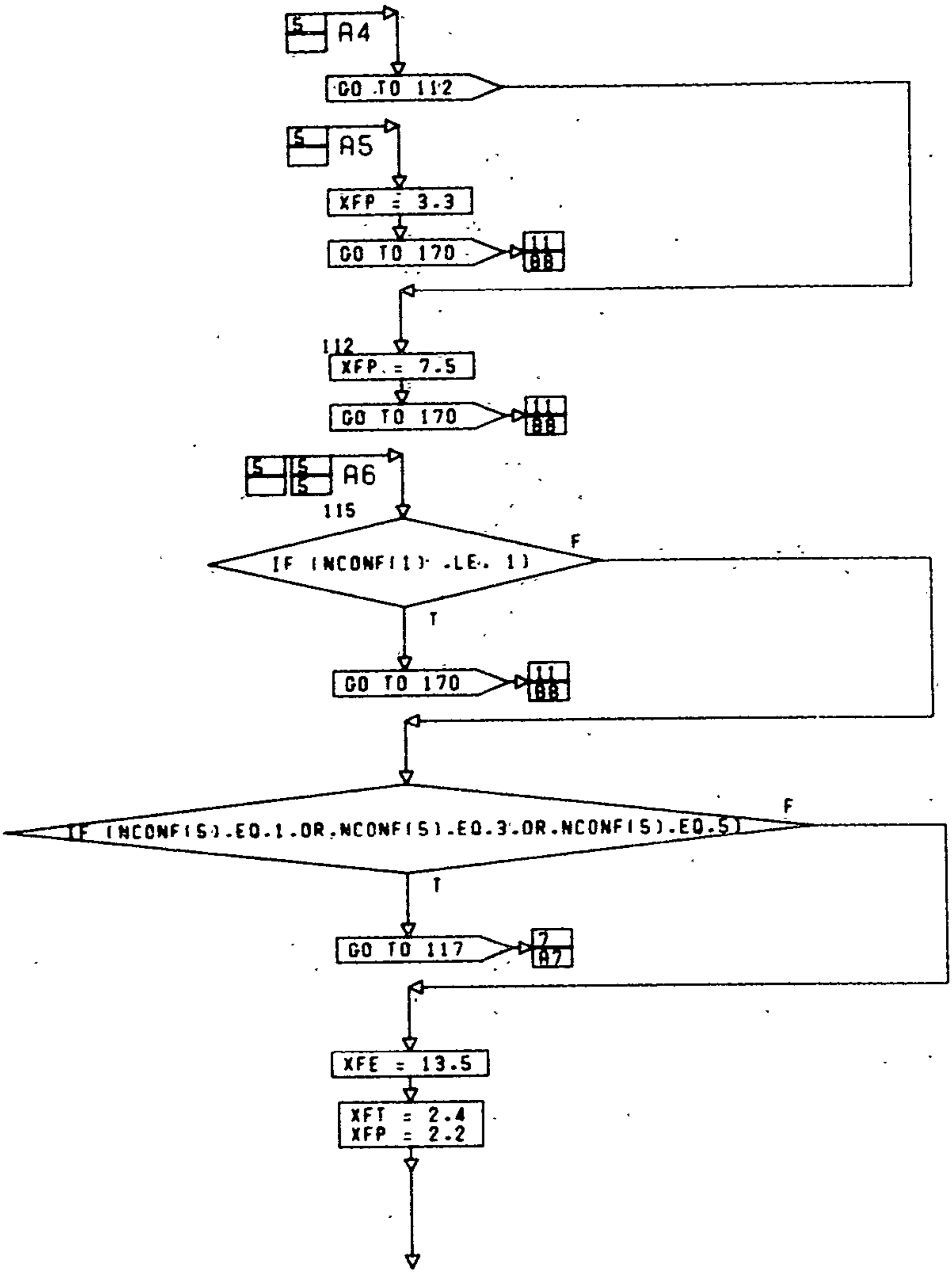

I=1
J=1
A1
12
100
IF (NCHOSE(I).EQ.0)
F
T
GO TO 200
12
C1
C ** COMPUTATIONS FOR CATALOG ITEMS
IF (I .GT. NEQUIP(J))
F
T
J=J+1
ICHS = ICHOSE(I)/100
XFP = 1.
XFE = 1.
XFT = 1.
C1= COST(1,I)
Q =NOV +NFV
QP = Q * NCHOSE(I)
QS=5.*NCHOSE(I)
PS = COST (3,I)
QREF = COST(4,I)
FQ = NCHOSE(I)/QREF
IF (FQ.LT.1.)
F
5
A3
T
5
A2

CONT. ON PG 5



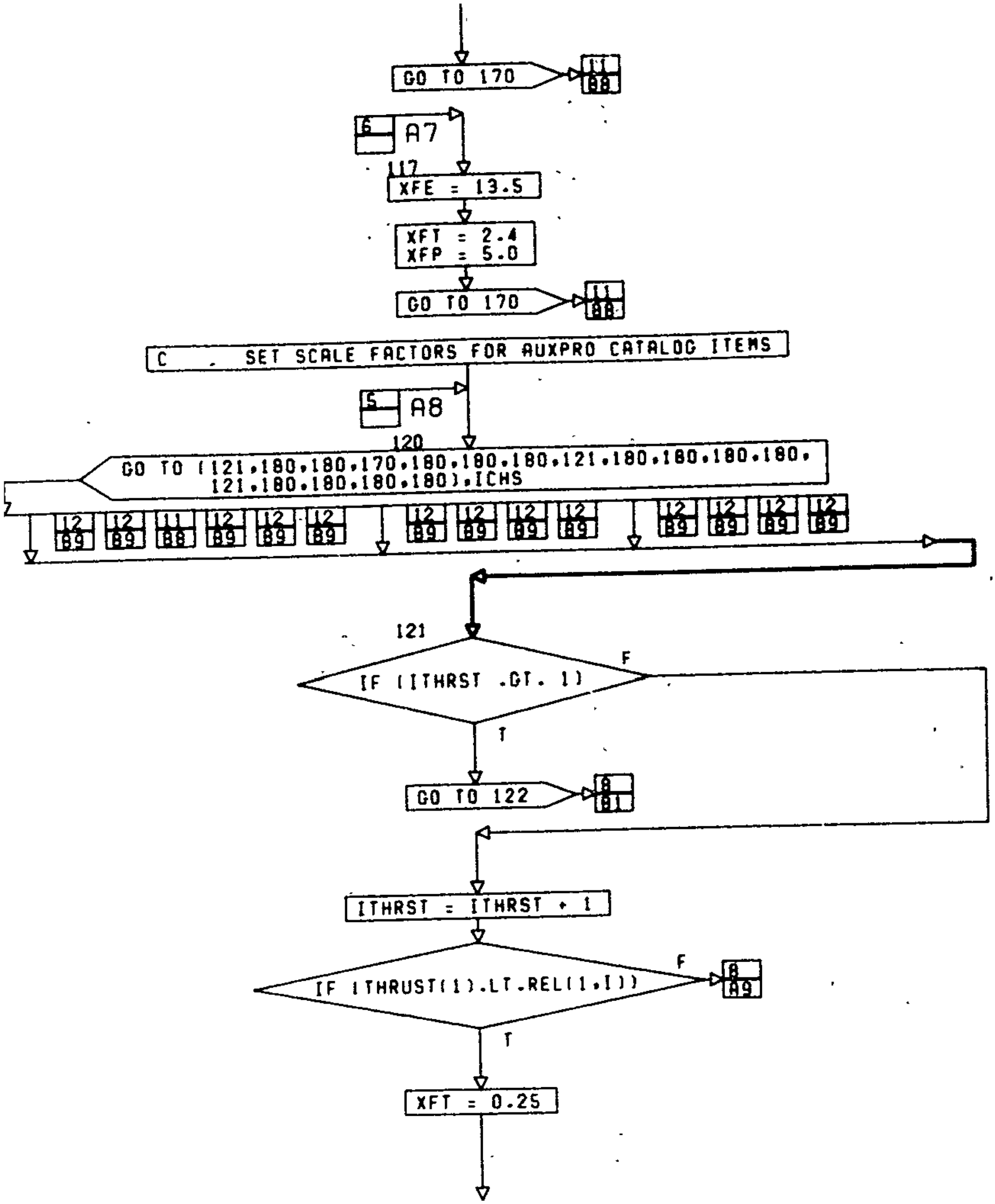
CONT. ON PG 6

032

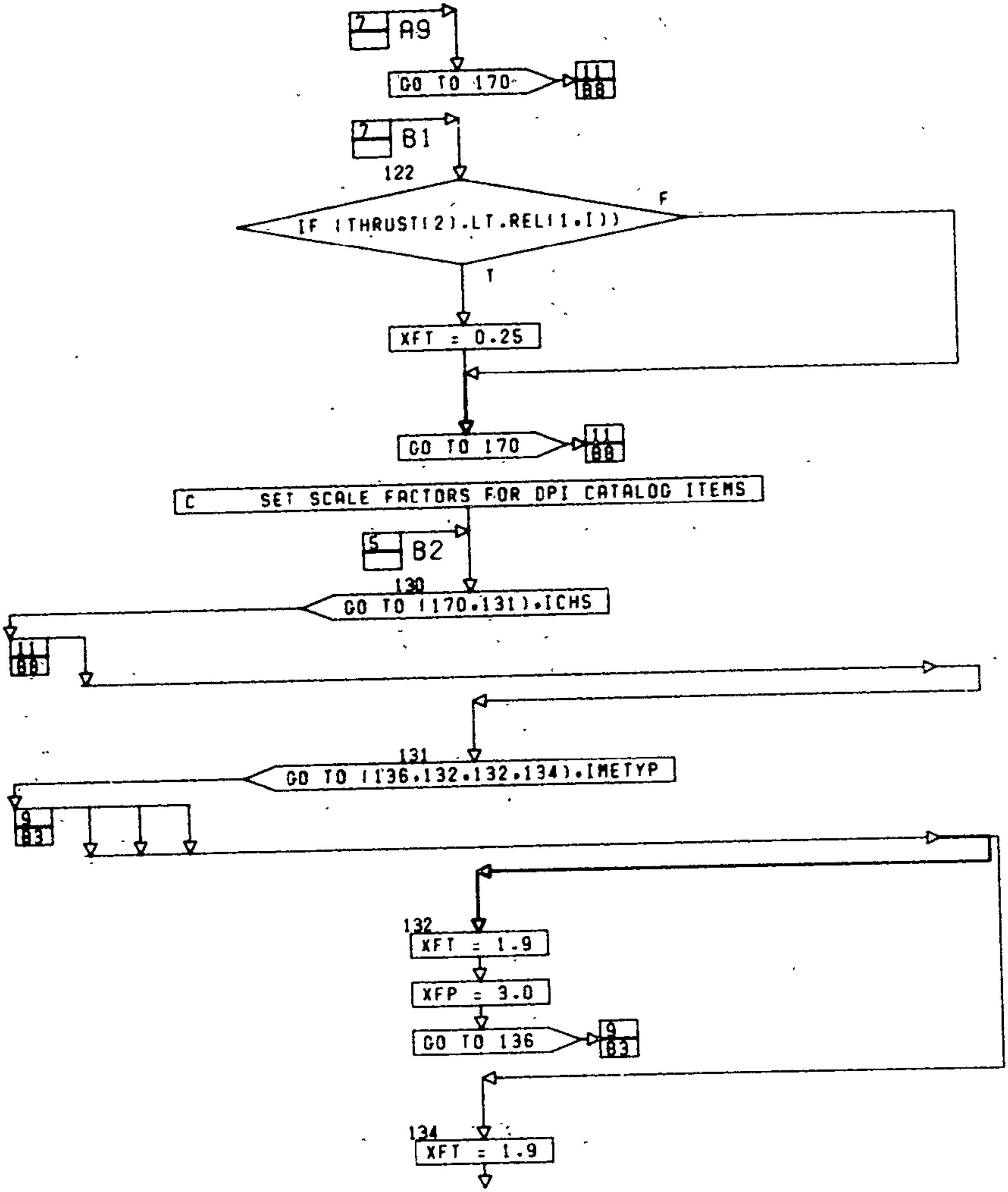


5
A4
GO TO 112
5
A5
XFP = 3.3
GO TO 170
11
BB
112
XFP = 7.5
GO TO 170
11
BB
5
5
5
A6
115
IF (NCONF(1) .LE. 1)
F
T
GO TO 170
11
BB
IF (NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)
F
T
GO TO 117
7
A7
XFE = 13.5
XFT = 2.4
XFP = 2.2

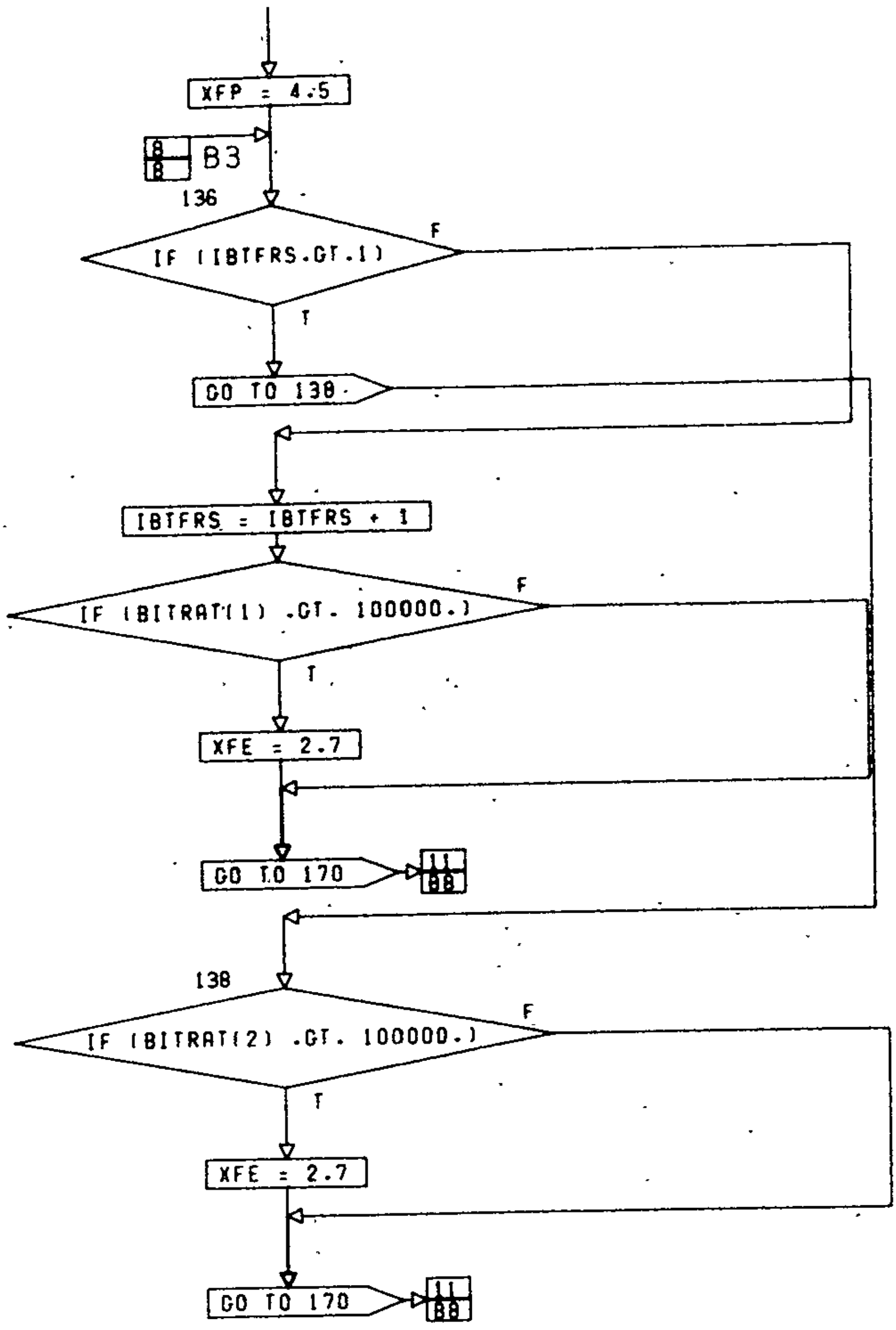
CONT. ON PG 7


GO TO 170
11
A8
6
A7
117
XFE = 13.5
XFT = 2.4
XFP = 5.0
GO TO 170
11
A8
C . SET SCALE FACTORS FOR AUXPRO CATALOG ITEMS
5
A8
120
GO TO (121,180,180,170,180,180,180,121,180,180,180,180,
121,180,180,180,180),ICHS
12
B9
11
B8
121
IF (ITHRST .GT. 1)
F
T
GO TO 122
8
B1
ITHRST = ITHRST + 1
IF (THRUST(1).LT.REL(1,I))
F
8
A9
T
XFT = 0.25

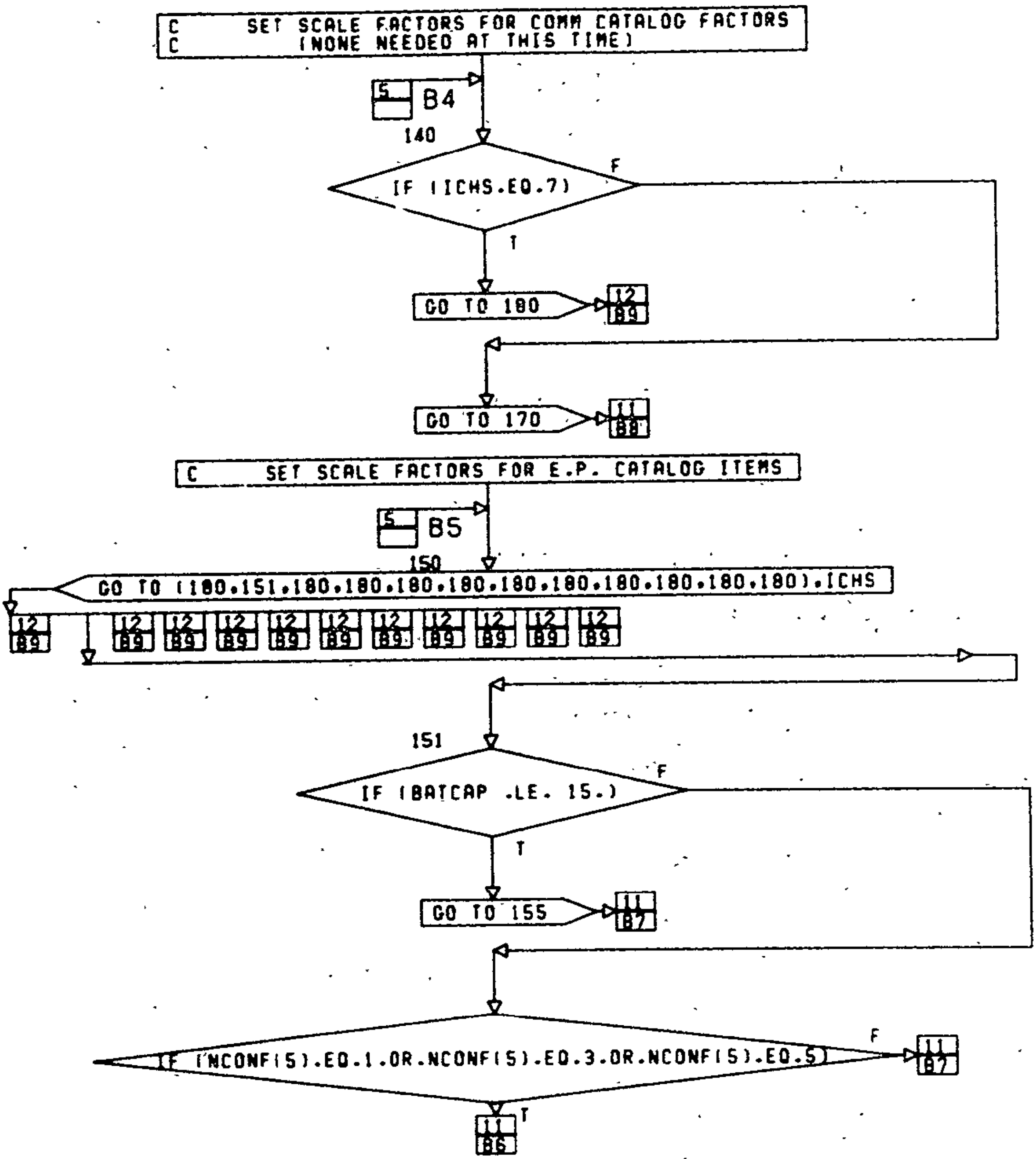
CONT. ON PG 8


7 A9
GO TO 170
11 B8
7 B1
122
IF (THRUST(2).LT.REL(1.I))
F
T
XFT = 0.25
GO TO 170
11 B8
C SET SCALE FACTORS FOR DPI CATALOG ITEMS
5 B2
130
GO TO (170,131),ICHS
11 B8
131
GO TO (136,132,132,134),IMETYP
9 B3
132
XFT = 1.9
XFP = 3.0
GO TO 136
9 B3
134
XFT = 1.9

CONT. ON PG. 9

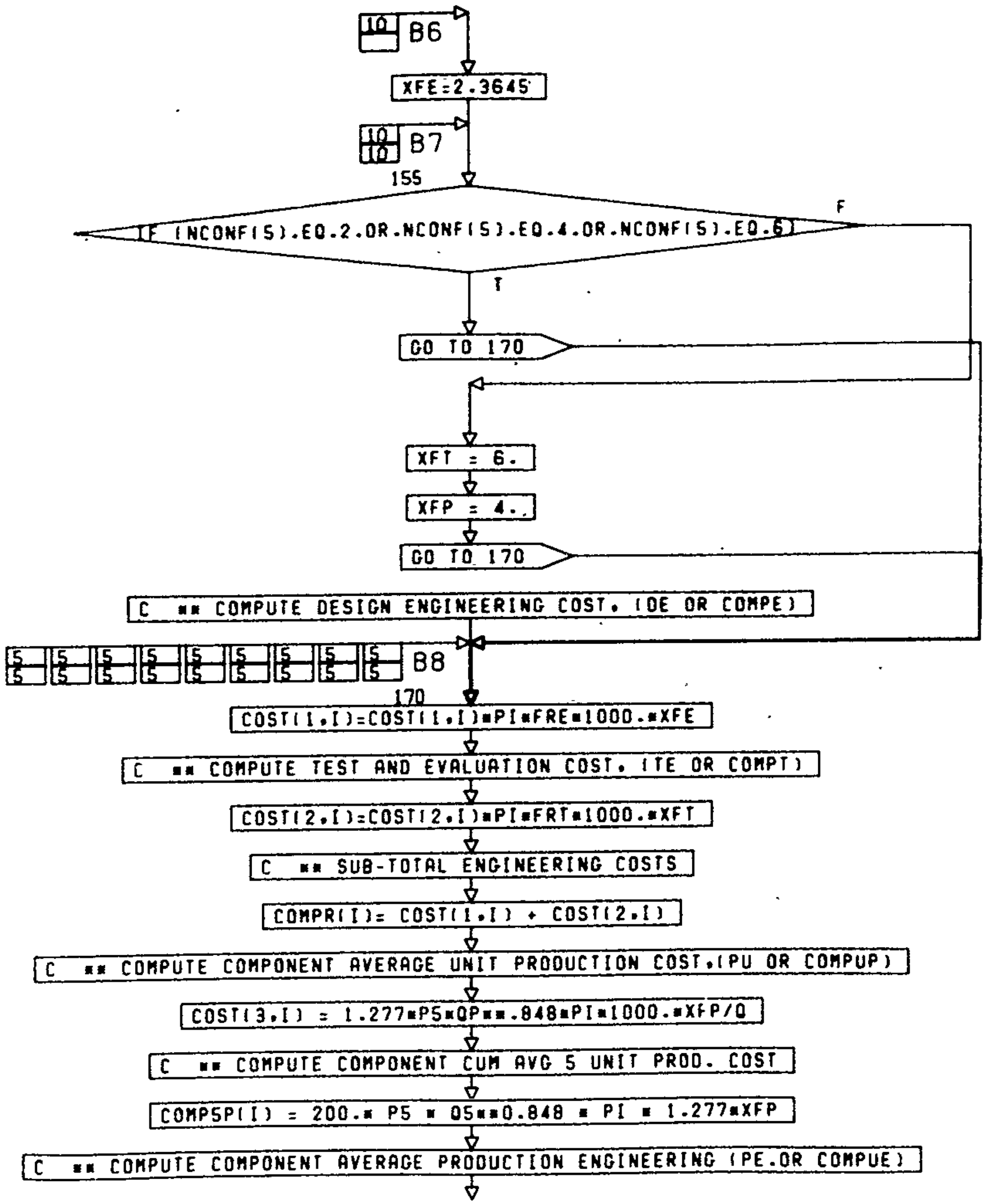

XFP = 4.5
8
B
B3
136
IF (IBTFRS.GT.1)
F
T
GO TO 138
IBTFRS = IBTFRS + 1
IF (BITRAT(1) .GT. 100000.)
F
T
XFE = 2.7
GO TO 170
11
BB
138
IF (BITRAT(2) .GT. 100000.)
F
T
XFE = 2.7
GO TO 170
11
BB

CONT. ON PG 10

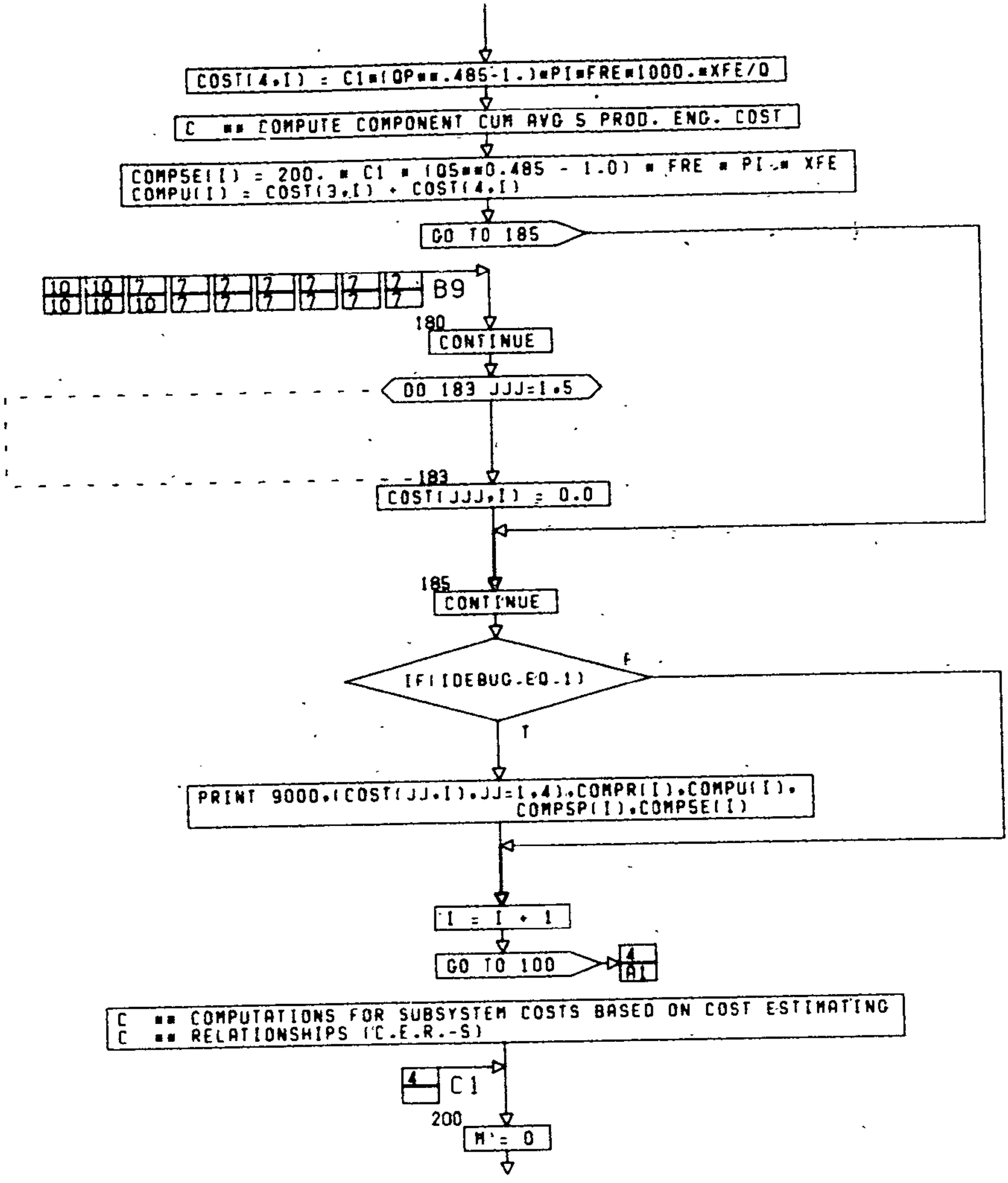


C SET SCALE FACTORS FOR COMM CATALOG FACTORS
C (NONE NEEDED AT THIS TIME)
5 B4
140
IF (ICHS.EQ.7)
F
T
GO TO 180
12 B9
GO TO 170
11 B8
C SET SCALE FACTORS FOR E.P. CATALOG ITEMS
5 B5
150
GO TO (180,151,180,180,180,180,180,180,180,180,180,180),ICHS
12 B9
151
IF (BATCAP .LE. 15.)
GO TO 155
11 B7
IF (NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)
11 B7
11 B6

CONT. ON PG 11

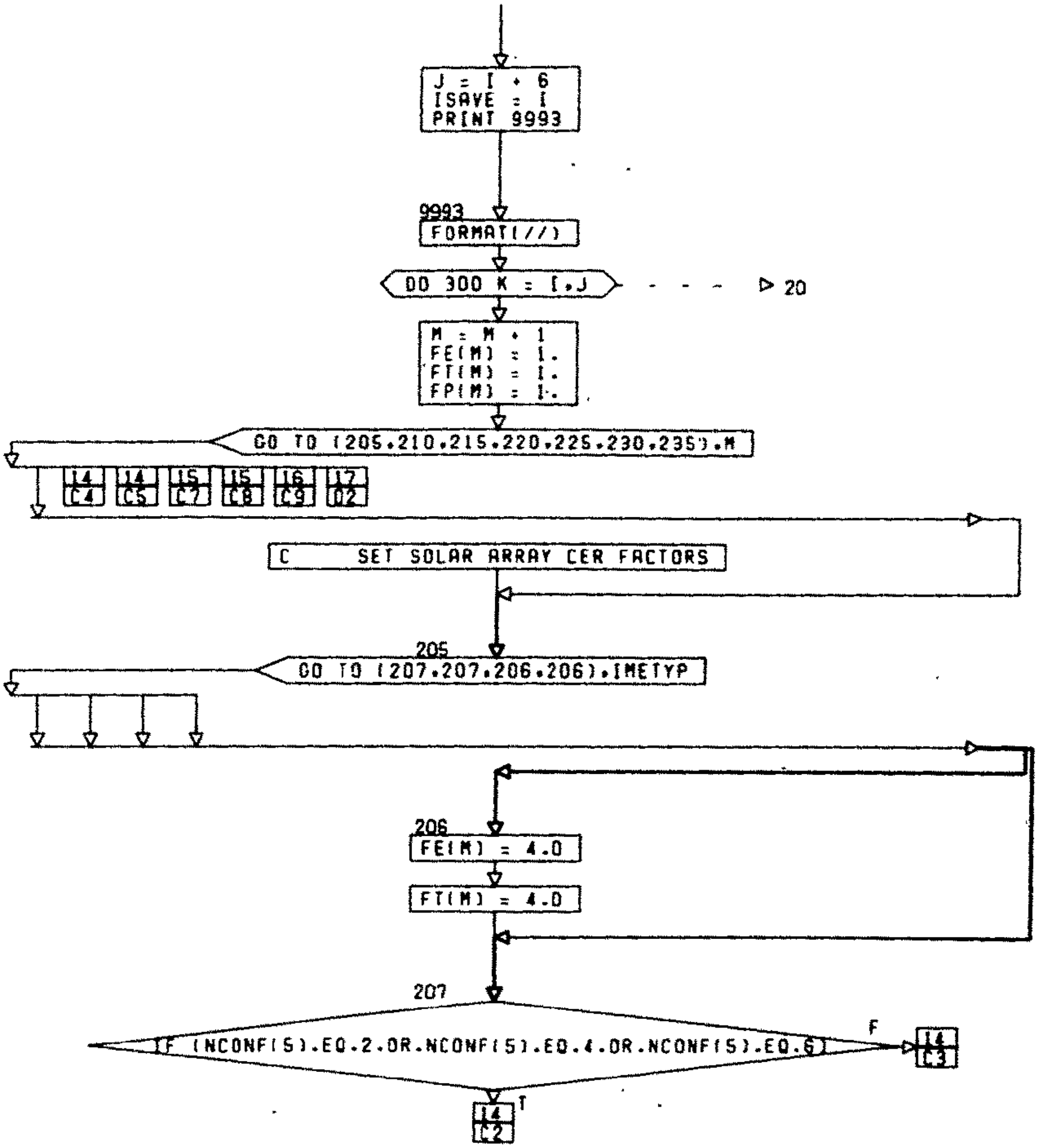

10
B6
XFE=2.3645
10
10
B7
155
IF (NCONF(5).EQ.2.OR.NCONF(5).EQ.4.OR.NCONF(5).EQ.6)
F
T
GO TO 170
XFT = 6.
XFP = 4.
GO TO 170
C ** COMPUTE DESIGN ENGINEERING COST. (DE OR COMPE)
5 5 5 5 5 5 5 5 5
5 5 5 5 5 5 5 5 5
B8
170
COST(1,I)=COST(1,I)*PI*FRE*1000.*XFE
C ** COMPUTE TEST AND EVALUATION COST. (TE OR COMPT)
COST(2,I)=COST(2,I)*PI*FRT*1000.*XFT
C ** SUB-TOTAL ENGINEERING COSTS
COMPR(I)= COST(1,I) + COST(2,I)
C ** COMPUTE COMPONENT AVERAGE UNIT PRODUCTION COST.(PU OR COMPUP)
COST(3,I) = 1.277*P5*QP**.848*PI*1000.*XFP/Q
C ** COMPUTE COMPONENT CUM AVG 5 UNIT PROD. COST
COMP5P(I) = 200.* P5 * Q5**0.848 * PI * 1.277*XFP
C ** COMPUTE COMPONENT AVERAGE PRODUCTION ENGINEERING (PE.OR COMPUE)

CONT. ON PG 12

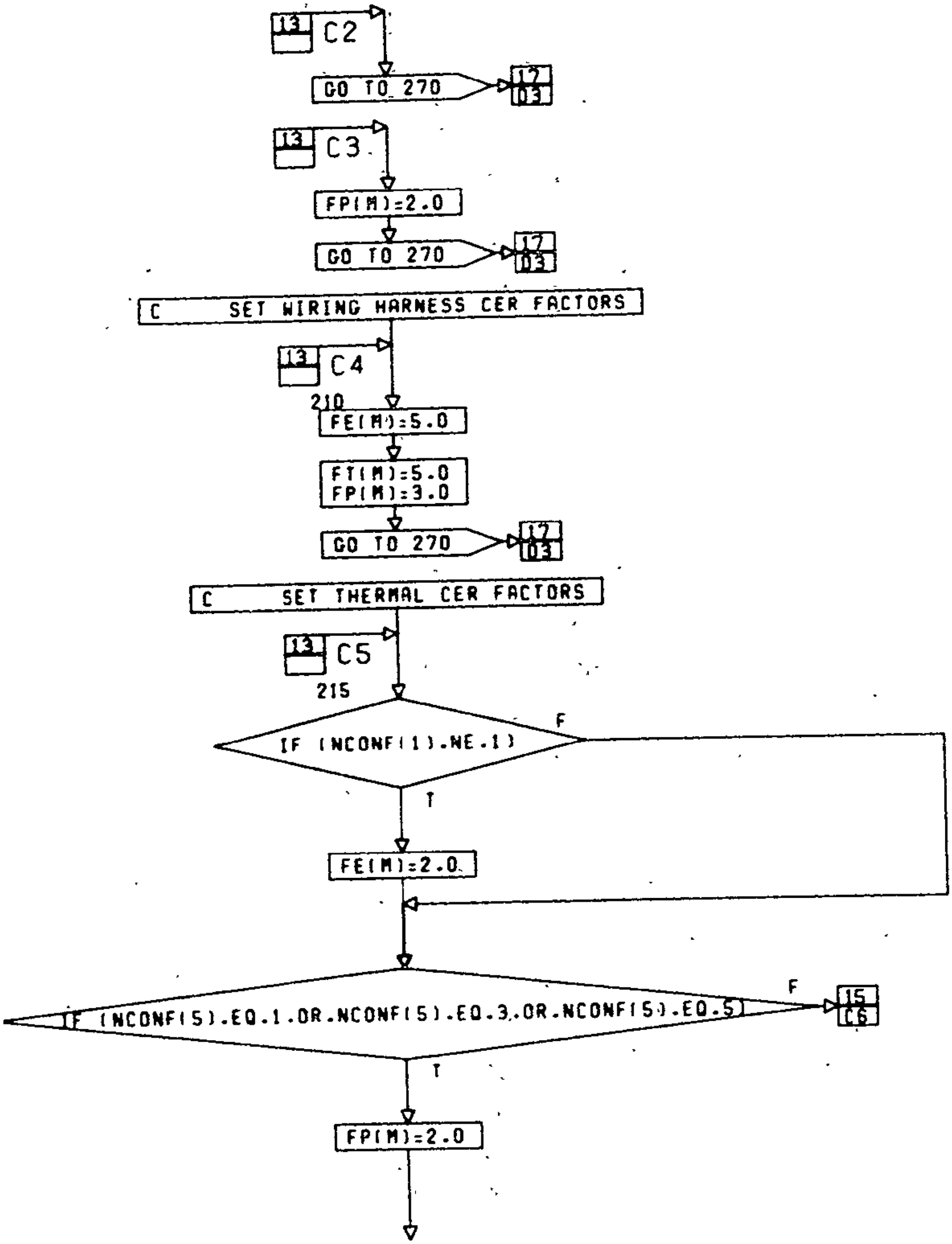


COST(4,I) = C1*(QP**.485-1.)*PI*FRE*1000.*XFE/Q
C ** COMPUTE COMPONENT CUM AVG 5 PROD. ENG. COST
COMPSE(I) = 200. * C1 * (05**0.485 - 1.0) * FRE * PI * XFE
COMPU(I) = COST(3,I) + COST(4,I)
GO TO 185
B9
180
CONTINUE
DO 183 JJJ=1,5
183
COST(JJJ,I) = 0.0
185
CONTINUE
IF(IDEBUG.EQ.1)
F
T
PRINT 9000,(COST(JJ,I),JJ=1,4),COMPR(I),COMPU(I),
COMPSP(I),COMPSE(I)
I = I + 1
GO TO 100
4
A1
C ** COMPUTATIONS FOR SUBSYSTEM COSTS BASED ON COST ESTIMATING
C ** RELATIONSHIPS (C.E.R.-S)
4
C1
200
M = 0

CONT. ON PG 13

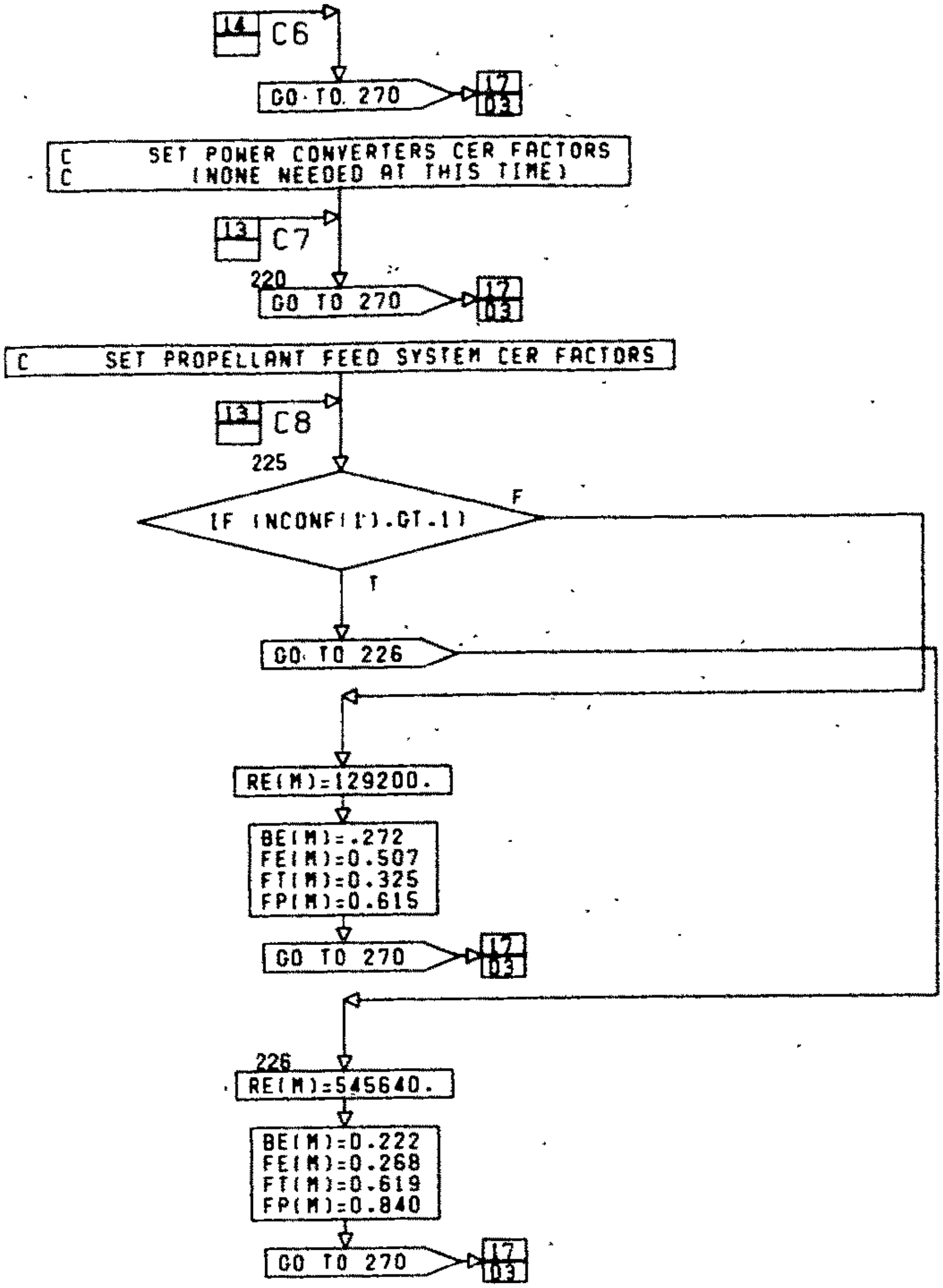

J = I + 6
ISAVE = I
PRINT 9993
9993
FORMAT(//)
DO 300 K = I,J
20
M = M + 1
FE(M) = 1.
FT(M) = 1.
FP(M) = 1.
GO TO (205,210,215,220,225,230,235),M
14 C4
14 C5
15 C7
15 C8
16 C9
17 D2
C SET SOLAR ARRAY CER FACTORS
205
GO TO (207,207,206,206),IMETYP
206
FE(M) = 4.0
FT(M) = 4.0
207
IF (NCONF(5).EQ.2.OR.NCONF(5).EQ.4.OR.NCONF(5).EQ.6)
F
14 C3
T
14 C2

CONT. ON PG 14

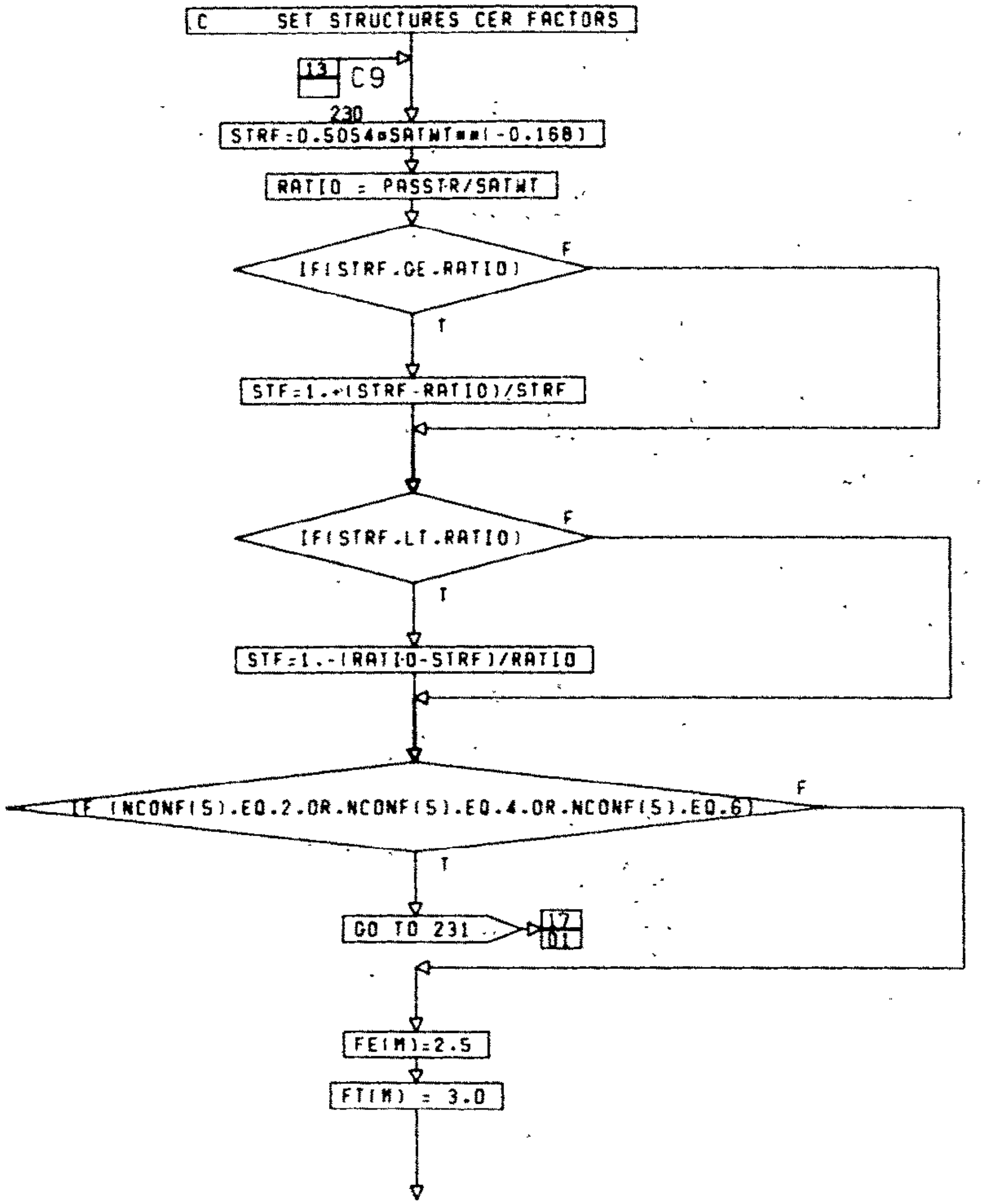


13
C2
GO TO 270
17
03
13
C3
FP(M)=2.0
GO TO 270
17
03
C SET WIRING HARNESS CER FACTORS
13
C4
210
FE(M)=5.0
FT(M)=5.0
FP(M)=3.0
GO TO 270
17
03
C SET THERMAL CER FACTORS
13
C5
215
IF (NCONF(1).NE.1)
F
T
FE(M)=2.0
IF (NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)
F
15
C6
T
FP(M)=2.0

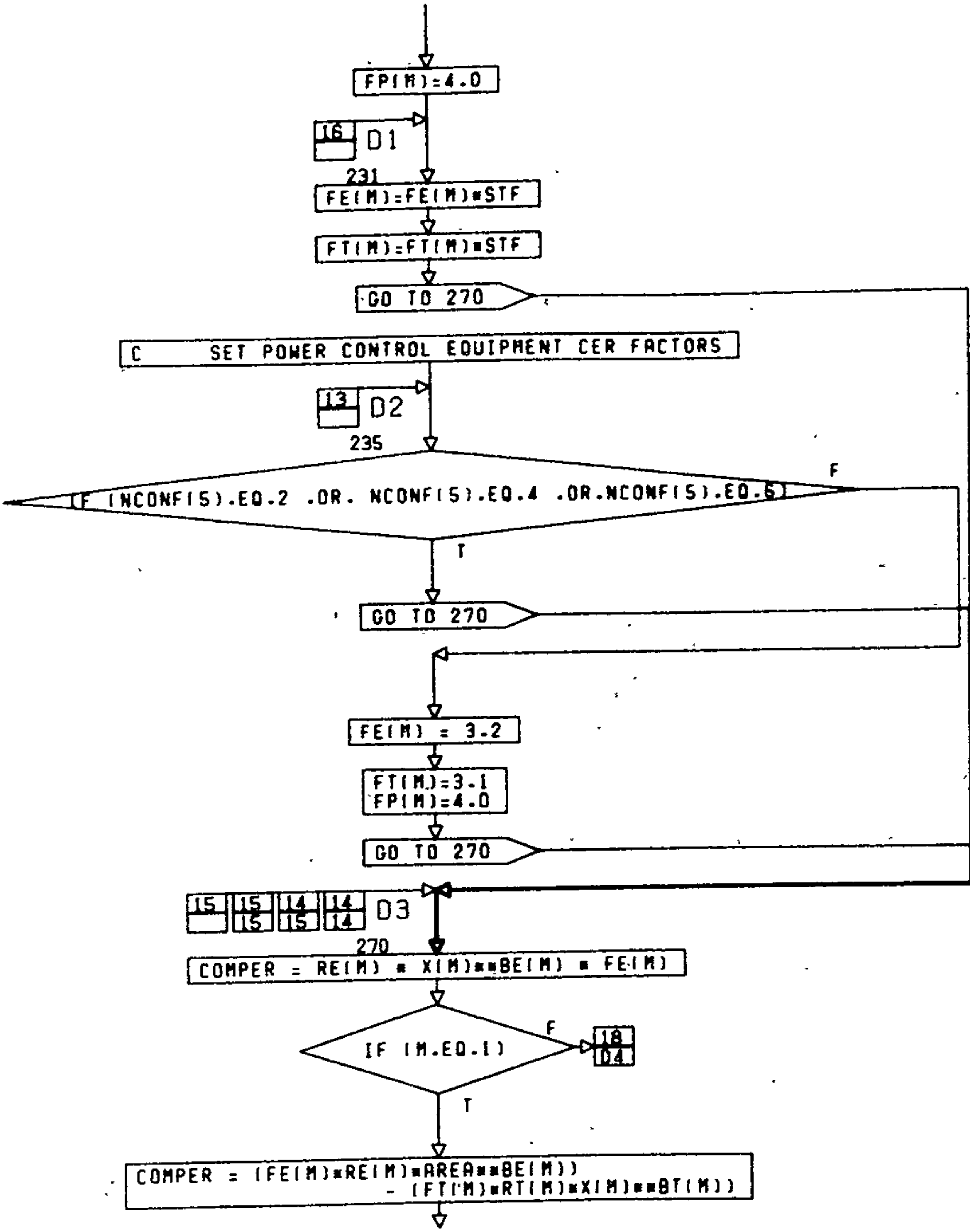
CONT. ON PG 15


14 C6
GO TO 270
17 03
C SET POWER CONVERTERS CER FACTORS
C (NONE NEEDED AT THIS TIME)
13 C7
220
GO TO 270
17 03
C SET PROPELLANT FEED SYSTEM CER FACTORS
13 C8
225
IF (NCONF(I).GT.1)
F
T
GO TO 226
RE(M)=129200.
BE(M)=.272
FE(M)=0.507
FT(M)=0.325
FP(M)=0.615
GO TO 270
17 03
226
RE(M)=545640.
BE(M)=0.222
FE(M)=0.268
FT(M)=0.619
FP(M)=0.840
GO TO 270
17 03

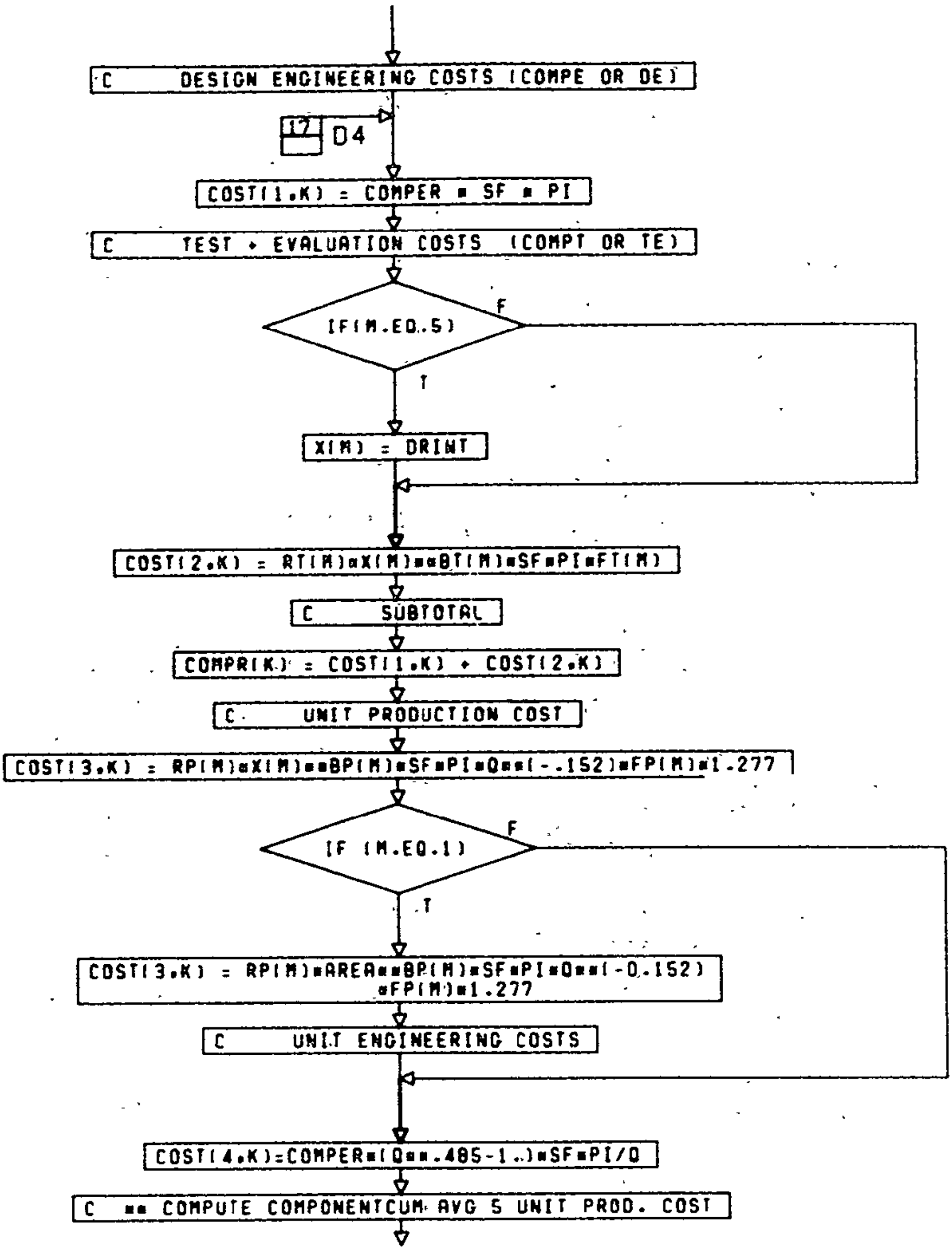
CONT. ON PG 16


C SET STRUCTURES CER FACTORS
13
C9
230
STRF=0.5054*SATWT**(-0.168)
RATIO = PASSTR/SATWT
IF(STRF.GE.RATIO)
F
T
STF=1.+(STRF-RATIO)/STRF
IF(STRF.LT.RATIO)
F
T
STF=1.-(RATIO-STRF)/RATIO
IF (NCONF(5).EQ.2.OR.NCONF(5).EQ.4.OR.NCONF(5).EQ.6)
F
T
GO TO 231
17
D1
FE(M)=2.5
FT(M) = 3.0

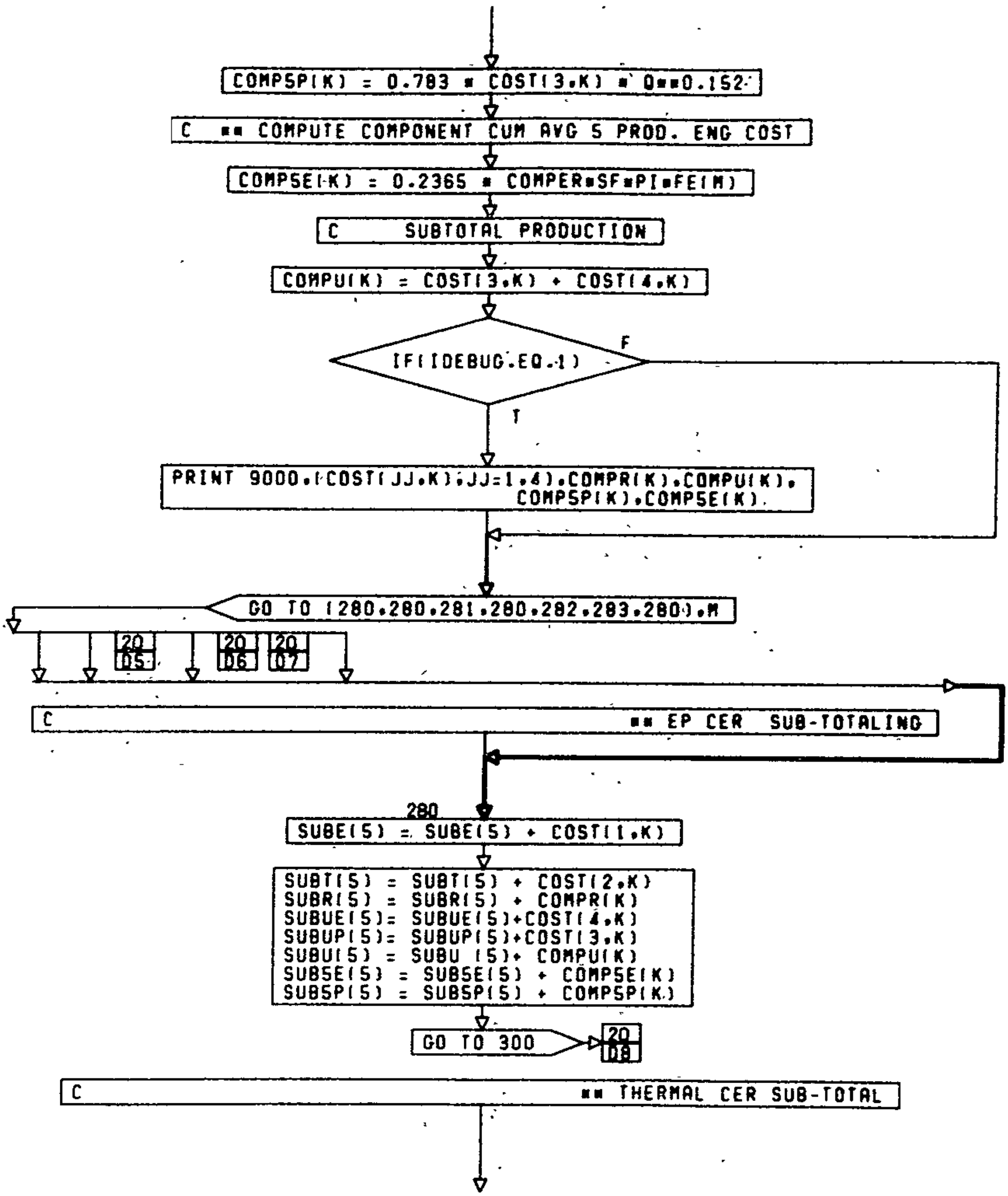
CONT. ON PG 17


FP(M)=4.0
16
D1
231
FE(M)=FE(M)*STF
FT(M)=FT(M)*STF
GO TO 270
C SET POWER CONTROL EQUIPMENT CER FACTORS
13
D2
235
IF (NCONF(5).EQ.2 .OR. NCONF(5).EQ.4 .OR.NCONF(5).EQ.6)
F
T
GO TO 270
FE(M) = 3.2
FT(M)=3.1
FP(M)=4.0
GO TO 270
15
15
15
14
15
14
14
D3
270
COMPER = RE(M) * X(M)**BE(M) * FE(M)
IF (M.EQ.1)
F
18
D4
T
COMPER = (FE(M)*RE(M)*AREA**BE(M))
- (FT(M)*RT(M)*X(M)**BT(M))

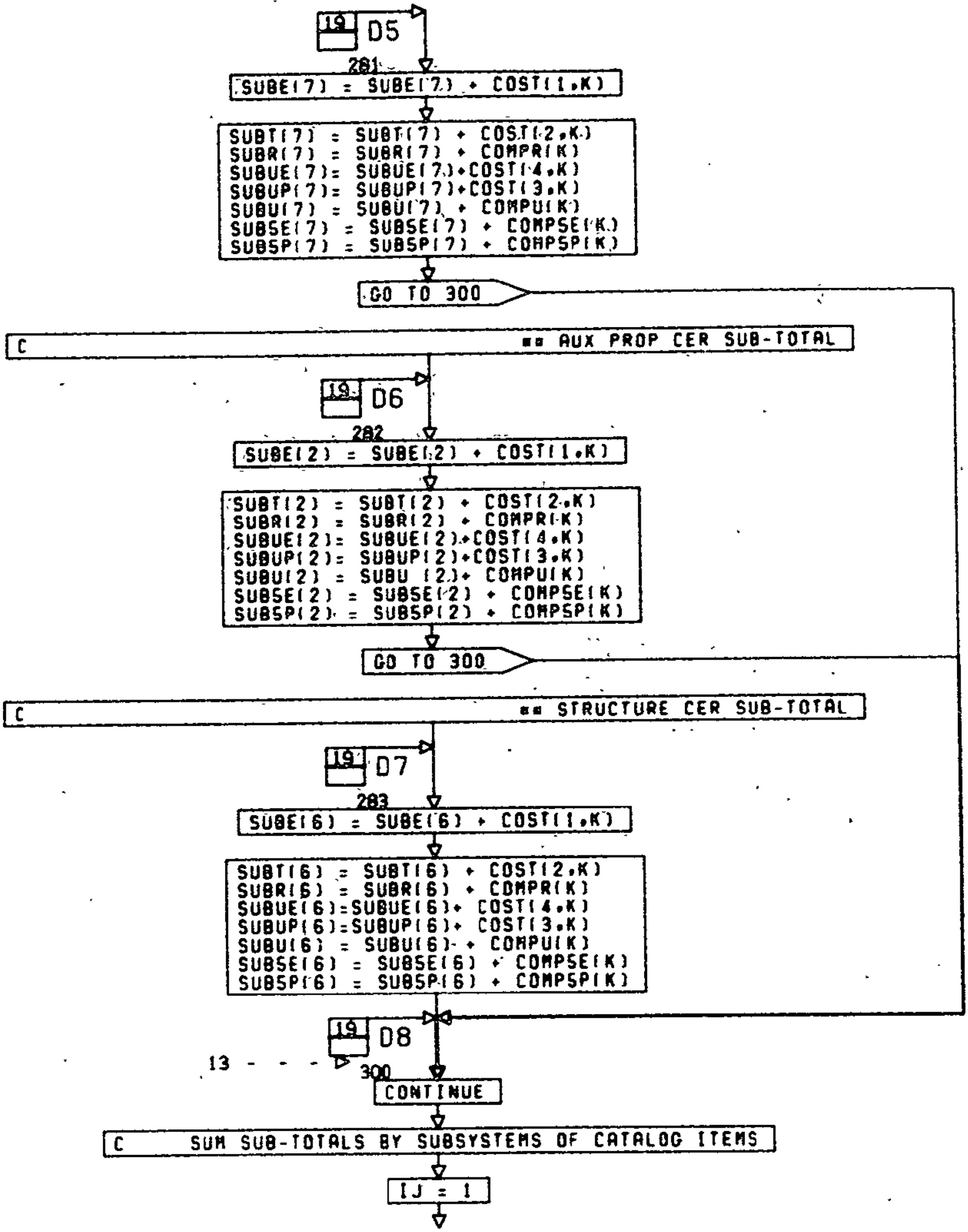
CONT. ON PG 18


C DESIGN ENGINEERING COSTS (COMPE OR DE)
17
D4
COST(1,K) = COMPER * SF * PI
C TEST + EVALUATION COSTS (COMPT OR TE)
IF(M.EQ.5)
F
T
X(M) = DRINT
COST(2,K) = RT(M)*X(M)**BT(M)*SF*PI*FT(M)
C SUBTOTAL
COMPR(K) = COST(1,K) + COST(2,K)
C UNIT PRODUCTION COST
COST(3,K) = RP(M)*X(M)**BP(M)*SF*PI*Q**(-.152)*FP(M)*1.277
IF (M.EQ.1)
F
T
COST(3,K) = RP(M)*AREA**BP(M)*SF*PI*Q**(-0.152)
*FP(M)*1.277
C UNIT ENGINEERING COSTS
COST(4,K)=COMPER*(Q**.485-1.)*SF*PI/Q
C ** COMPUTE COMPONENTCUM AVG 5 UNIT PROD. COST

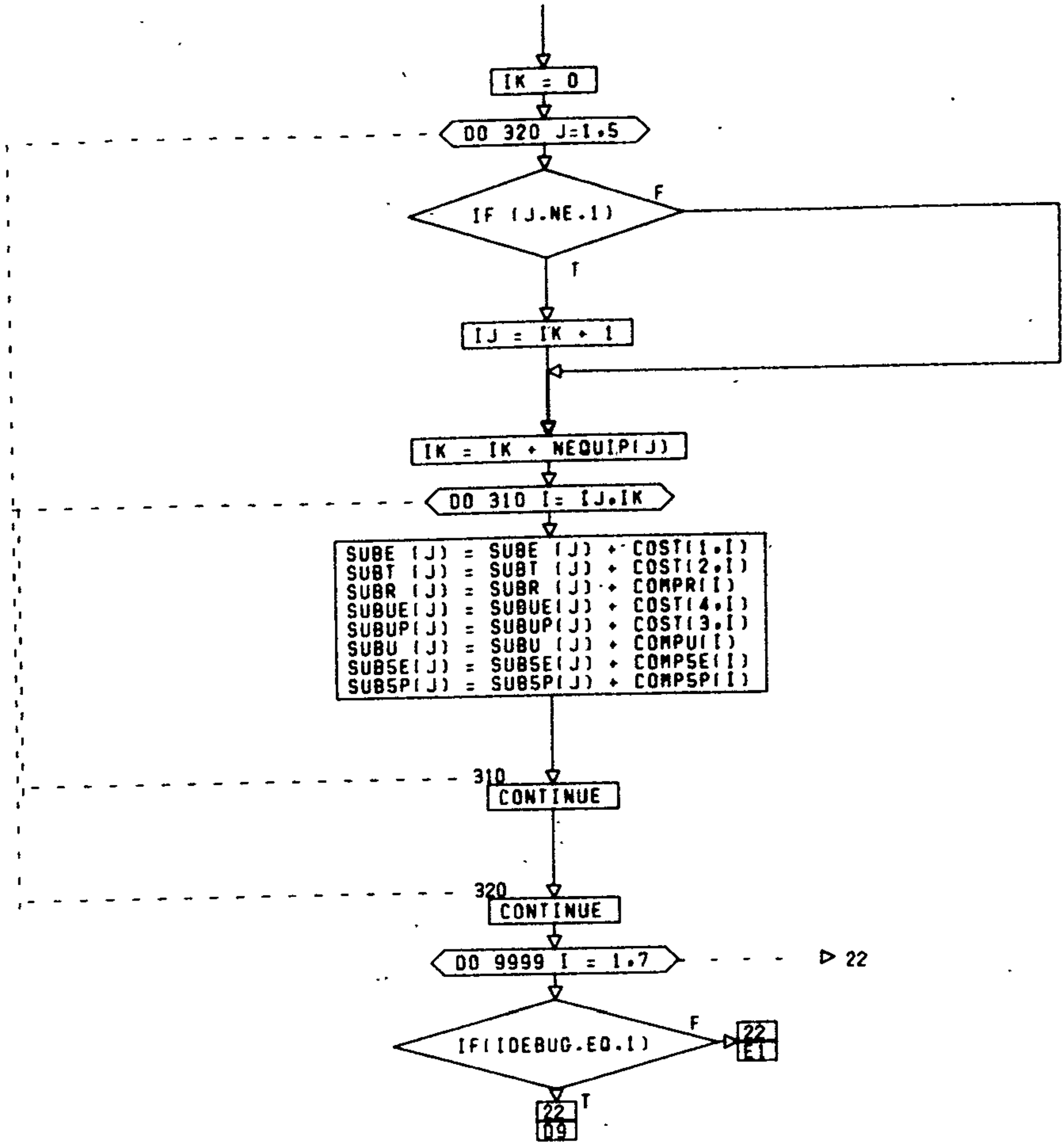
CONT. ON PG 19


COMPSP(K) = 0.783 * COST(3,K) * Q**0.152
C ** COMPUTE COMPONENT CUM AVG 5 PROD. ENG COST
COMPSE(K) = 0.2365 * COMPER*SF*PI*FE(M)
C SUBTOTAL PRODUCTION
COMPU(K) = COST(3,K) + COST(4,K)
IF(IDEBUG.EQ.1)
F
T
PRINT 9000,(COST(JJ,K),JJ=1,4),COMPR(K),COMPU(K), COMPSP(K),COMPSE(K)
GO TO (280,280,281,280,282,283,280),M
20 05
20 06
20 07
C ** EP CER SUB-TOTALING
280
SUBE(5) = SUBE(5) + COST(1,K)
SUBT(5) = SUBT(5) + COST(2,K)
SUBR(5) = SUBR(5) + COMPR(K)
SUBUE(5)= SUBUE(5)+COST(4,K)
SUBUP(5)= SUBUP(5)+COST(3,K)
SUBU(5) = SUBU (5)+ COMPU(K)
SUBSE(5) = SUBSE(5) + COMPSE(K)
SUBSP(5) = SUBSP(5) + COMPSP(K)
GO TO 300
20 08
C ** THERMAL CER SUB-TOTAL

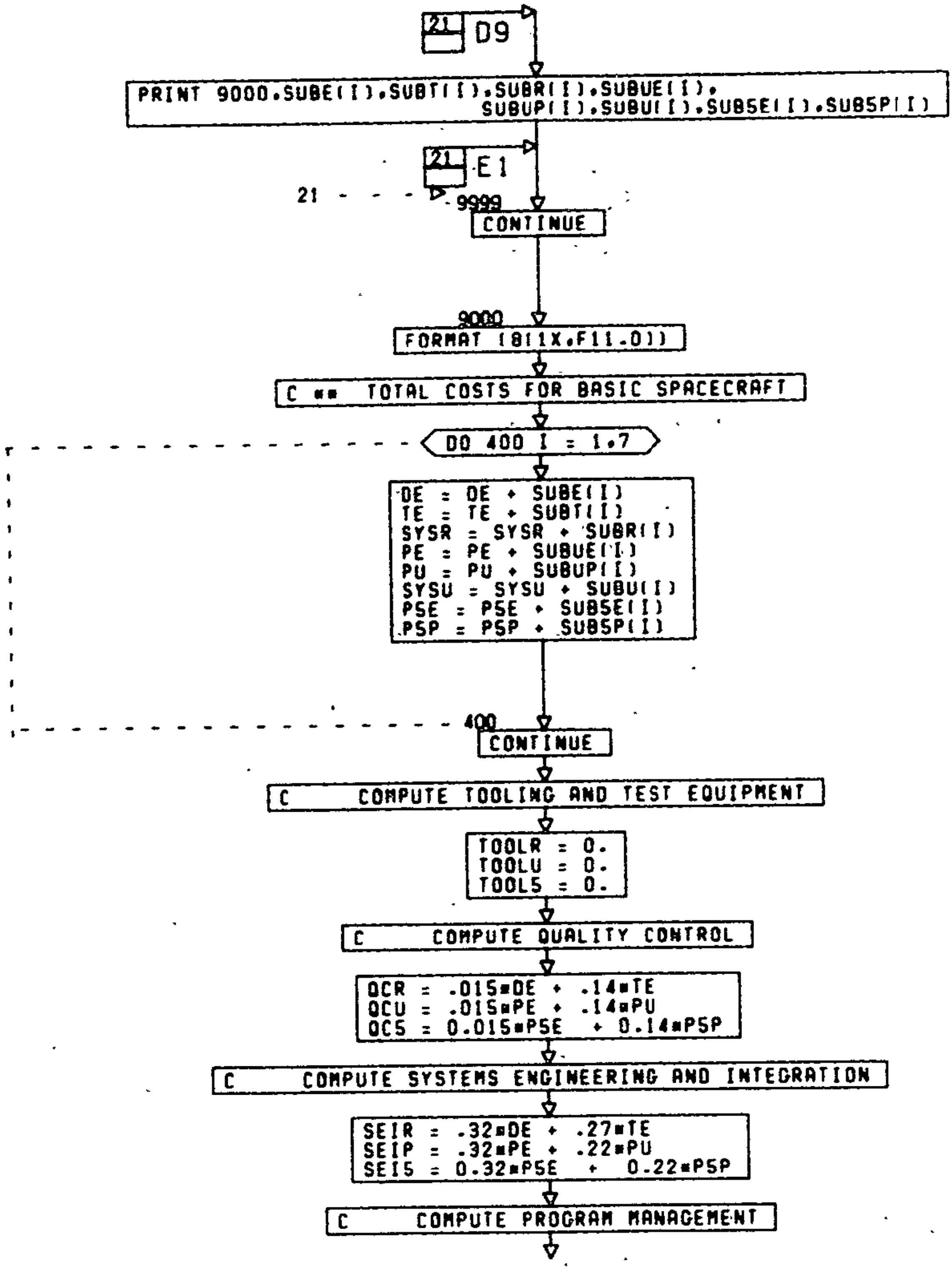
CONT. ON PG 20


19 D5
281
SUBE(7) = SUBE(7) + COST(1,K)
SUBT(7) = SUBT(7) + COST(2,K)
SUBR(7) = SUBR(7) + COMPR(K)
SUBUE(7)= SUBUE(7)+COST(4,K)
SUBUP(7)= SUBUP(7)+COST(3,K)
SUBU(7) = SUBU(7) + COMPU(K)
SUBSE(7) = SUBSE(7) + COMPSE(K)
SUBSP(7) = SUBSP(7) + COMPSP(K)
GO TO 300
C ** AUX PROP CER SUB-TOTAL
19 D6
282
SUBE(2) = SUBE(2) + COST(1,K)
SUBT(2) = SUBT(2) + COST(2,K)
SUBR(2) = SUBR(2) + COMPR(K)
SUBUE(2)= SUBUE(2)+COST(4,K)
SUBUP(2)= SUBUP(2)+COST(3,K)
SUBU(2) = SUBU (2)+ COMPU(K)
SUBSE(2) = SUBSE(2) + COMPSE(K)
SUBSP(2) = SUBSP(2) + COMPSP(K)
GO TO 300
C ** STRUCTURE CER SUB-TOTAL
19 D7
283
SUBE(6) = SUBE(6) + COST(1,K)
SUBT(6) = SUBT(6) + COST(2,K)
SUBR(6) = SUBR(6) + COMPR(K)
SUBUE(6)=SUBUE(6)+ COST(4,K)
SUBUP(6)=SUBUP(6)+ COST(3,K)
SUBU(6) = SUBU(6) + COMPU(K)
SUBSE(6) = SUBSE(6) + COMPSE(K)
SUBSP(6) = SUBSP(6) + COMPSP(K)
19 D8
13
300
CONTINUE
C SUM SUB-TOTALS BY SUBSYSTEMS OF CATALOG ITEMS
IJ = 1

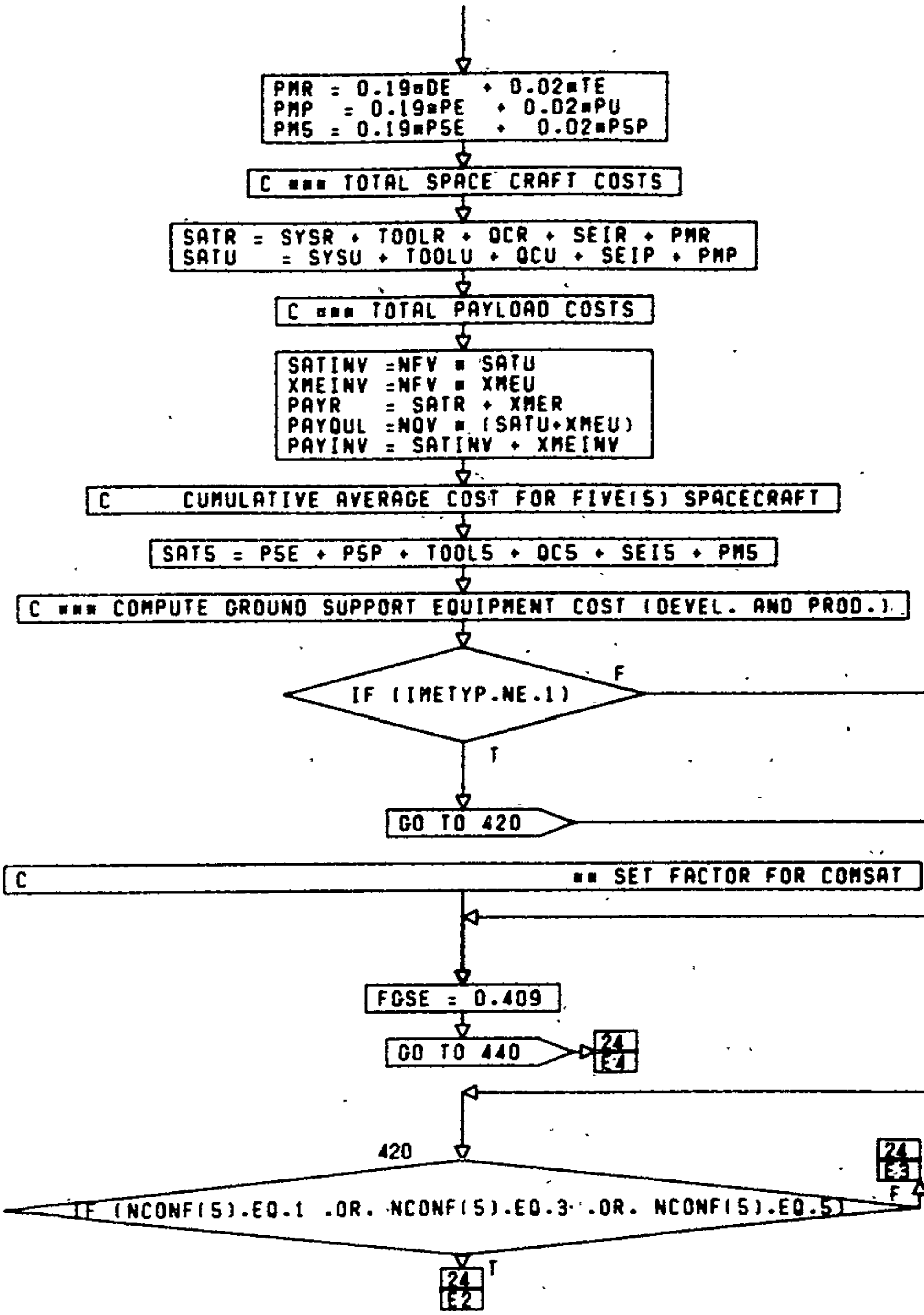
CONT. ON PG 21


IK = 0
DO 320 J=1,5
IF (J.NE.1)
F
T
IJ = IK + 1
IK = IK + NEQUIP(J)
DO 310 I= IJ,IK
SUBE (J) = SUBE (J) + COST(1,I)
SUBT (J) = SUBT (J) + COST(2,I)
SUBR (J) = SUBR (J) + COMPR(I)
SUBUE(J) = SUBUE(J) + COST(4,I)
SUBUP(J) = SUBUP(J) + COST(3,I)
SUBU (J) = SUBU (J) + COMPU(I)
SUBSE(J) = SUBSE(J) + COMPSE(I)
SUBSP(J) = SUBSP(J) + COMPSP(I)
310
CONTINUE
320
CONTINUE
DO 9999 I = 1,7
22
IF(IDEBUG.EQ.1)
F
22
E1
T
22
D9

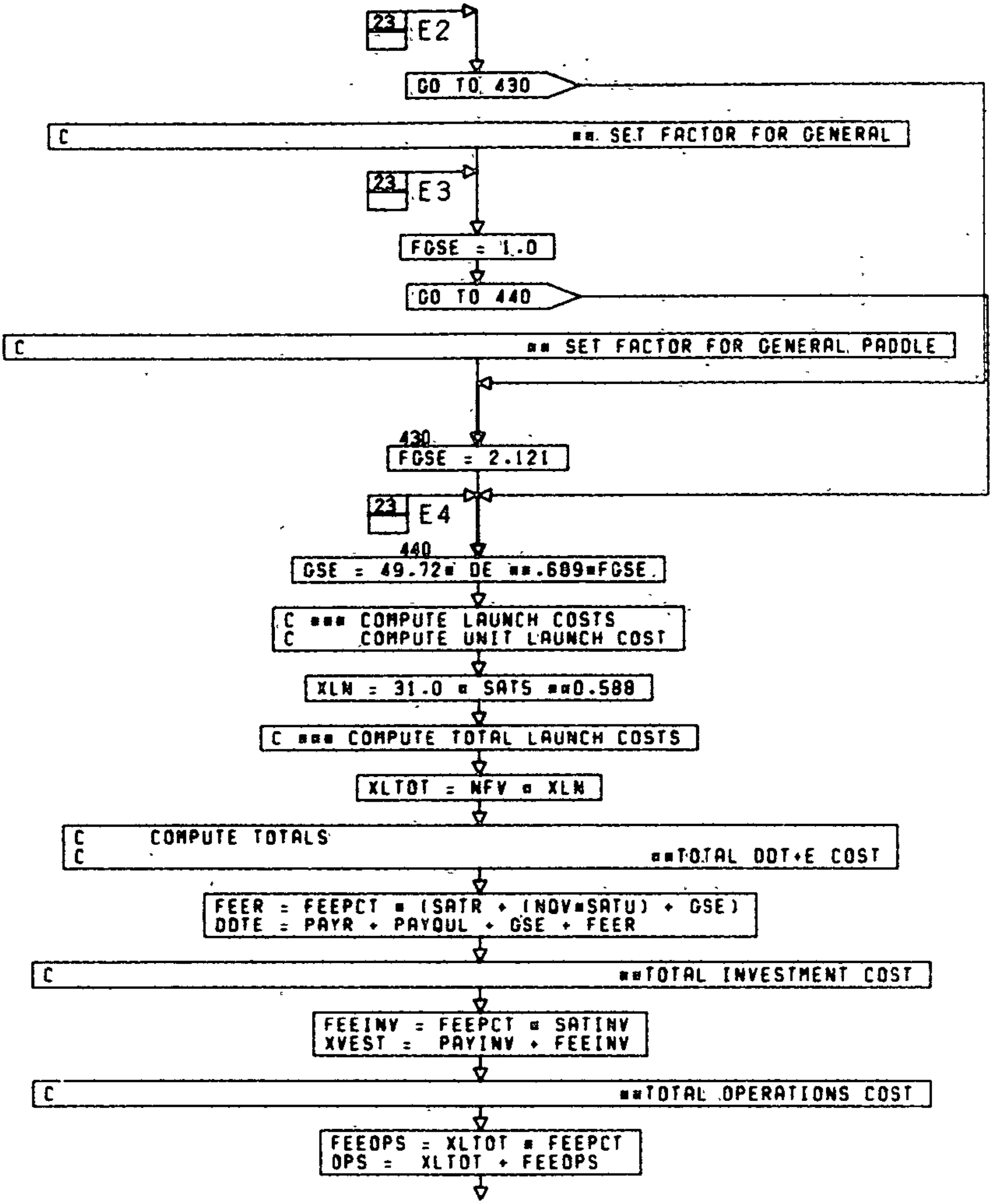
CONT. ON PG 22


21 D9
PRINT 9000,SUBE(I),SUBT(I),SUBR(I),SUBUE(I),
SUBUP(I),SUBU(I),SUB5E(I),SUB5P(I)
21 E1
21
9999
CONTINUE
9000
FORMAT (8(1X,F11.0))
C ** TOTAL COSTS FOR BASIC SPACECRAFT
DO 400 I = 1,7
DE = DE + SUBE(I)
TE = TE + SUBT(I)
SYSR = SYSR + SUBR(I)
PE = PE + SUBUE(I)
PU = PU + SUBUP(I)
SYSU = SYSU + SUBU(I)
PSE = PSE + SUB5E(I)
PSP = PSP + SUB5P(I)
400
CONTINUE
C COMPUTE TOOLING AND TEST EQUIPMENT
TOOLR = 0.
TOOLU = 0.
TOOL5 = 0.
C COMPUTE QUALITY CONTROL
QCR = .015*DE + .14*TE
QCU = .015*PE + .14*PU
QC5 = 0.015*PSE + 0.14*PSP
C COMPUTE SYSTEMS ENGINEERING AND INTEGRATION
SEIR = .32*DE + .27*TE
SEIP = .32*PE + .22*PU
SEI5 = 0.32*PSE + 0.22*PSP
C COMPUTE PROGRAM MANAGEMENT

CONT. ON PG 23


PMR = 0.19*DE + 0.02*TE
PMP = 0.19*PE + 0.02*PU
PMS = 0.19*PSE + 0.02*PSP
C *** TOTAL SPACE CRAFT COSTS
SATR = SYSR + TOOLR + QCR + SEIR + PMR
SATU = SYSU + TOOLU + QCU + SEIP + PMP
C *** TOTAL PAYLOAD COSTS
SATINV =NFV * SATU
XMEINV =NFV * XMEU
PAYR = SATR + XMER
PAYQUL =NQV * (SATU+XMEU)
PAYINV = SATINV + XMEINV
C CUMULATIVE AVERAGE COST FOR FIVE(5) SPACECRAFT
SATS = PSE + PSP + TOOLS + QCS + SEIS + PMS
C *** COMPUTE GROUND SUPPORT EQUIPMENT COST (DEVEL. AND PROD.)
IF (IMETYP.NE.1)
F
T
GO TO 420
C ** SET FACTOR FOR COMSAT
FGSE = 0.409
GO TO 440
24
E4
420
24
E3
IF (NCONF(5).EQ.1 .OR. NCONF(5).EQ.3 .OR. NCONF(5).EQ.5)
F
T
24
E2

CONT. ON PG 24


23 E2
GO TO 430
C ** SET FACTOR FOR GENERAL
23 E3
FGSE = 1.0
GO TO 440
C ** SET FACTOR FOR GENERAL PADDLE
430 FGSE = 2.121
23 E4
440 GSE = 49.72* DE **.689*FGSE
C *** COMPUTE LAUNCH COSTS
C COMPUTE UNIT LAUNCH COST
XLN = 31.0 * SATS **0.588
C *** COMPUTE TOTAL LAUNCH COSTS
XLTOT = NFV * XLN
C COMPUTE TOTALS
C **TOTAL DDT+E COST
FEER = FEEPCT * (SATR + (NOV*SATU) + GSE)
DDTE = PAYR + PAYQUL + GSE + FEER
C **TOTAL INVESTMENT COST
FEEINV = FEEPCT * SATINV
XVEST = PAYINV + FEEINV
C **TOTAL OPERATIONS COST
FEEOPS = XLTOT * FEEPCT
OPS = XLTOT + FEEOPS

CONT. ON PG 25

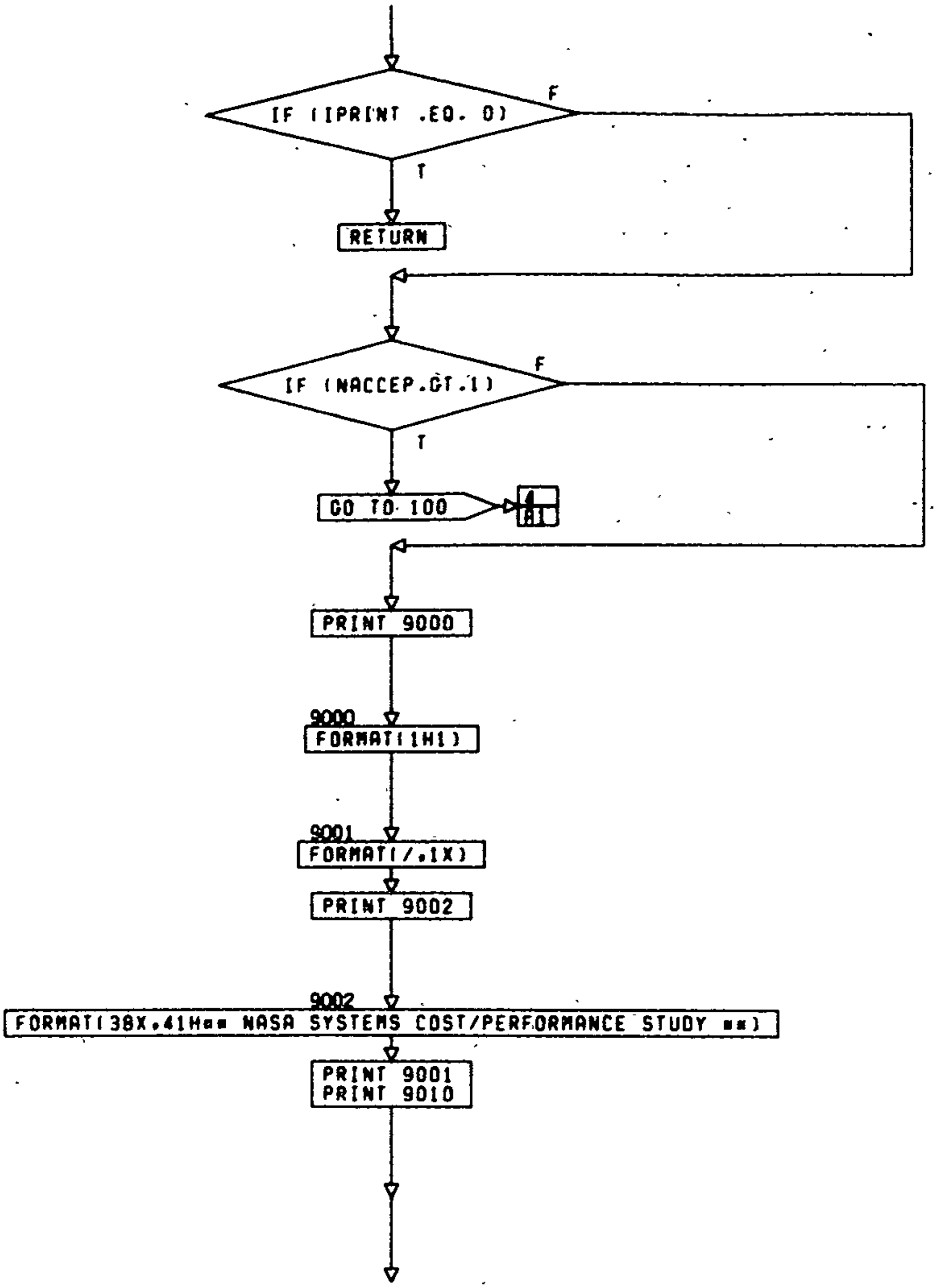
RETURN

END

PG 25 FINAL

```
SUBROUTINE PRNT (IERR,NEQUIP,NACCEP,NCONF)

C **  THIS IS THE OUTPUT SUBROUINE WHICH CONTROLS THE PRINTED        **
C **  OUTPUT OF ANY ACCEPTABLE DESIGN                                 **
C **

COMMON /USERI/   APOGEE,  COMRAT,  DIAMAX, EEQWT(9),   EPME,
                 EQM1WT,  EQM1XL,  EQM1YL,  EQM1ZL,  EQM2WT,
                 EQM2XL,  EQM2YL,  EQM2ZL,      FE,  IAGNCY,
        IDEBUG,  ISATOR,  MB12SH,  OPTEMP,  ORBINC,  PERIGE,
         MICRO,   RELME, SPEC(6),   SPEC1,   XDUM1,  XCOSA1,
                   XMER,    XMEU

COMMON /USERP/ IPRINT,ITITLE

COMMON /BTWN/      ACSSN,   ACSWP,     ALT,    AREA,  BATCAP,
               BITRAT(2),   CLIFE,  CONVWT,       D,      DT,
                      DX,      DY,      DZ,   EQBLG,  EQBSID,
                      FC,      FF,  HARNWT,     HPT,  HTPIPE,
                    HTPT,  HTRPRB,  HTRPWR,           IBTLOC,
                   LMBDD,      NC,  OMEGS,   PASSTR,      PJ,
                      PL,   PLMIN,  POCNWT,    RADA,   RADAB,
                     RAT,      RJ,  SABOLG,   SATLG,  SATTWT,

                   SATWT,  SATXCG,  SATYCG,  SATZCG,   SA1XL,
                   SA1YL,   SA1ZL,    SIDE,   SYSLB,  THCMWT,
               THRUST(2),      TI,   TNKWT,   TPRIM,      VB,
                    VCHP,     VOL,    WATE,      WB,     WBT,
                      WT,      XJ,  XNZERO,      YJ,      ZJ

COMMON /CHOSE/    COST(5,60),      DPIA(11,60),     ICHOSE(60),
                  NCHOSE(60),      REL ( 6,60),     SKD(7,60),
                  THM(4,60)

COMMON/PRTCOM/   ACCRCY,      AM,      AN,      BF,      BS,
              COPI(7,2),  CISTAR,    CTOT,    DDTE,      DE,
                 DRIWT,   EQBSTR,  FEEINV,  FEEOPS,    FEER,
                   GSE,     IREL,  ITRUNC,  MMDOLD,NAME(3,60),
                   OPS,   PAYINV,  PAYOUL,    PAYR,      PE,
                   PMP,      PMR, POWER(6),     PU,  PWR(60),
                   QCP,      QCR, ROLD(60),  SABMWT,  SATADP,
                SATINV,     SATR,    SEIP,    SEIR, SKTAU(6),

             SSREL(6),  SUBE(7),  SUBT(7), SUBUE(7), SUBUP(7),
                    TA, TAU(6,6),      TB,      TC,      TE,
                    TF,    TOOLR,   TOOLU,  TOTOPS,   TRUNC,
                    TS,        T,VOLUME(6), VOL(60),WEIGHT(6),
                 XLTOT,     XMEH,  XMEINV,    XMEL,   XMEVL,
                  XMEW,    XMEWT,   XVEST

DIMENSION IERR(7),NEQUIP(5),NCONF(6)
DIMENSION ITITLE(13)
REAL MMDOLD
MMDOLD=MMDOLD/720.
TRUNC=TRUNC/720.
```

CONT. ON PG 2


IF (IPRINT .EQ. 0)
F
T
RETURN
IF (NACCEP.GT.1)
F
T
GO TO 100
4
A1
PRINT 9000
9000
FORMAT(1H1)
9001
FORMAT(/,1X)
PRINT 9002
9002
FORMAT(38X,41H** NASA SYSTEMS COST/PERFORMANCE STUDY **)
PRINT 9001
PRINT 9010

CONT. ON PG 3

9010

```
FORMAT (16H DEFINITIONS - -,/,25H   CONFIGURATIONS (NCONF),/,5X,
36HSTABILIZATION AND CONTROL (NCONF(1)),15X,31HAUXILIARY PROPULSIO
N (NCONF(2)),/,7X,23HNCONF(1)=1 IS DUAL SPIN,28X,22HNCONF(2)=1 IS
COLD GAS,/,7X,22HNCONF(1)=2 IS YAW SPIN,29X,28HNCONF(2)=2 IS MONOP
ROPELLANT,/,7X,28HNCONF(1)=3 IS MASS EXPULSION,23X,26HNCONF(2)=3 I
S BIPROPELLANT,/,7X,37HNCONF(1)=4 IS MASS EXPULSION W/ CMG-S,12X,2
5HCOMMUNICATIONS (NCONF(4)),/,7X,38HNCONF(1)=5 IS MASS EXPULSION W
/ M.W.-S,13X,42HNCONF(4)=1 IS SEPARATE UPLINK AND DOWNLINK,/,5X,46
```

```
HDATA PROCESSING AND INSTRUMENTATION (NCONF(3)),7X,42HNCONF(4)=2 I
S UNIFIED LINK-COMMON ANTENNAS,/,7X,39HNCONF(3)=1 IS GENERAL PURPO
SE PROCESSOR,12X,44HNCONF(4)=3 IS UNIFIED LINK-SEPARATE ANTENNAS,/
,7X,39HNCONF(3)=2 IS SPECIAL PURPOSE PROCESSOR,12X,48HNCONF(4)=4 I
S UNIFIED LINK-COMMON ANT + DOWNLINK,/,5X,27HELECTRICAL POWER (NCO
NF(5)),26X,50HNCONF(4)=5 IS UNIFIED LINK-SEPARATE ANT + DOWNLINK,/
,7X,44HNCONF(5)=1 IS SHUNT REGULATION - PADDLE MTD.,5X,25HVEHICLE
SIZING (NCONF(6)),/,7X,42HNCONF(5)=2 IS SHUNT REGULATION - BODY MT
```

```
D.,9X,22HNCONF(6)=1 IS CYLINDER,/,7X,44HNCONF(5)=3 IS SHNT + DISCH
.REG - PADDLE MTD.,7X,17HNCONF(6)=2 IS BOX,/,7X,42HNCONF(5)=4 IS S
HNT + DISCH.REG - BODY MTD.,9X,20HNCONF(6)=3 IS SPHERE)
```

```
PRINT 9011
```

9011

```
FORMAT (7X,44HNCONF(5)=5 IS SERIES LOAD REG. - PADDLE MTD.,5X,11HR
ELIABILITY,/,7X,42HNCONF(5)=6 IS SERIES LOAD REG. - BODY MTD.,9X,4
5HREDUNDANCY CONFIGURATION = 0 IS SINGLE SYSTEM,/,58X,43HREDUNDANC
Y CONFIGURATION = 1 IS DUAL SYSTEM)
```

```
PRINT 9001
PRINT 9012
```

9012

```
FORMAT (18H   MESSAGES (IERR),/,5X,25HSTABILIZATION AND CONTROL,26
X,20HAUXILIARY PROPULSION,/,7X,29HIERR =     0 MEANS NO MESSAGES,22
X,27HIERR =   0 MEANS NO MESSAGES,/,7X,49HIERR =     1 MEANS MAX ALL
OWABLE SYS. ERROR UNSAT.,2X,50HIERR =  1 MEANS CYCLE LIFE OF ATTIT
UDE CONTROL     ,/,7X,42HIERR =   1X MEANS MAX RATE ERROR TOO SMALL
,25X,22HTHRUSTERS IS TOO SHORT,/,7X,42HIERR =   1XX MEANS 3-AXIS WH
EELS ACCEPTABLE,9X,52HIERR = 10 MEANS CYCLE LIFE OF TRANSLATIONAL
THRUSTER,/,7X,42HIERR = 1XXX MEANS DBL GIMB.CMGS ACCEPTABLE,25X,12
```

CONT. ON PG 4

```
HIS TOO SHORT./.5X.35HDATA PROCESSING AND INSTRUMENTATION.18X.49HI
ERR = 11 MEANS CYCLE LIVES OF BOTH THRUSTERS ARE./.7X.30HIERR =
 0 MEANS NO MESSAGES.37X.9HTOO SHORT./.7X.31HIERR =      1 MEANS M
UX REQUIRED.18X.7HTHERMAL./.7X.41HIERR =     10 WORD LENGTH GREATER
 THAN 256.10X. 49HIERR = 1XXXXXXXXX MEANS BATT RAD AREA IS SUPPLIE
D./.7X.34HIERR =    100 BIT RATE IS TOO LARGE.35X.8HIN RADAB./.7X.3
6HIERR =  1000 SPEC.COMD.SYNC.FLG NE 0.15X.  51HIERR = X1XXXXXXXX
MEANS OSR CONV. AND VARIABLE COND ./.7X.36HIERR = 10000 END OF DAT
```

```
A BASE SENSED.33X.34HUCTANCE HEAT PIPE INFO IS REQUIRED./.5X.14HVE
HICLE SIZING.39X.45HIERR = XX1XXXXXXX MEANS PHASE CONTROL MASS IS)
```

```
PRINT 9013
```

```
9013
FORMAT (7X.26HIERR = 0 MEANS NO MESSAGES.43X.15HSUPPLIED IN PCM./.
7X.46HIERR = 1 MEANS BODY MOUNTED SOLAR ARRAY LENGTH.5X.50HIERR =
XXX1XXXXXX MEANS ISOTHERMALIZER IS REQUIRED./.16X.28HEXCEEDS EQUIP
MENT BAY LENGTH.14X.51HIERR = XXXX1XXXXX MEANS DIODE HEAT PIPE IS
REQUIRED./.76X.12H(2 REQUIRED)./.58X.51HIERR = XXXXX1XXXX MEANS CO
NV. HEAT PIPE IS REQUIRED./.58X.48HIERR = XXXXXX1XXX MEANS OSR RAD
IATOR IS REQUIRED./.58X.50HIERR = XXXXXXX1XX MEANS CONV. RADIATOR
IS REQUIRED./.58X.48HIERR = XXXXXXXX1X MEANS HEATER POWER IS SUPPL
```

```
IED./.76X.9HIN HTRPWR./.58X.49HIERR = XXXXXXXXX1 MEANS RADIATOR AR
EA IS SUPPLIED./.76X.7HIN RADA)
```

```
C ****************************************************************
C **  THIS IS THE BEGINNING OF THE SYSTEM LEVEL OUTPUT          **
C ****************************************************************
```

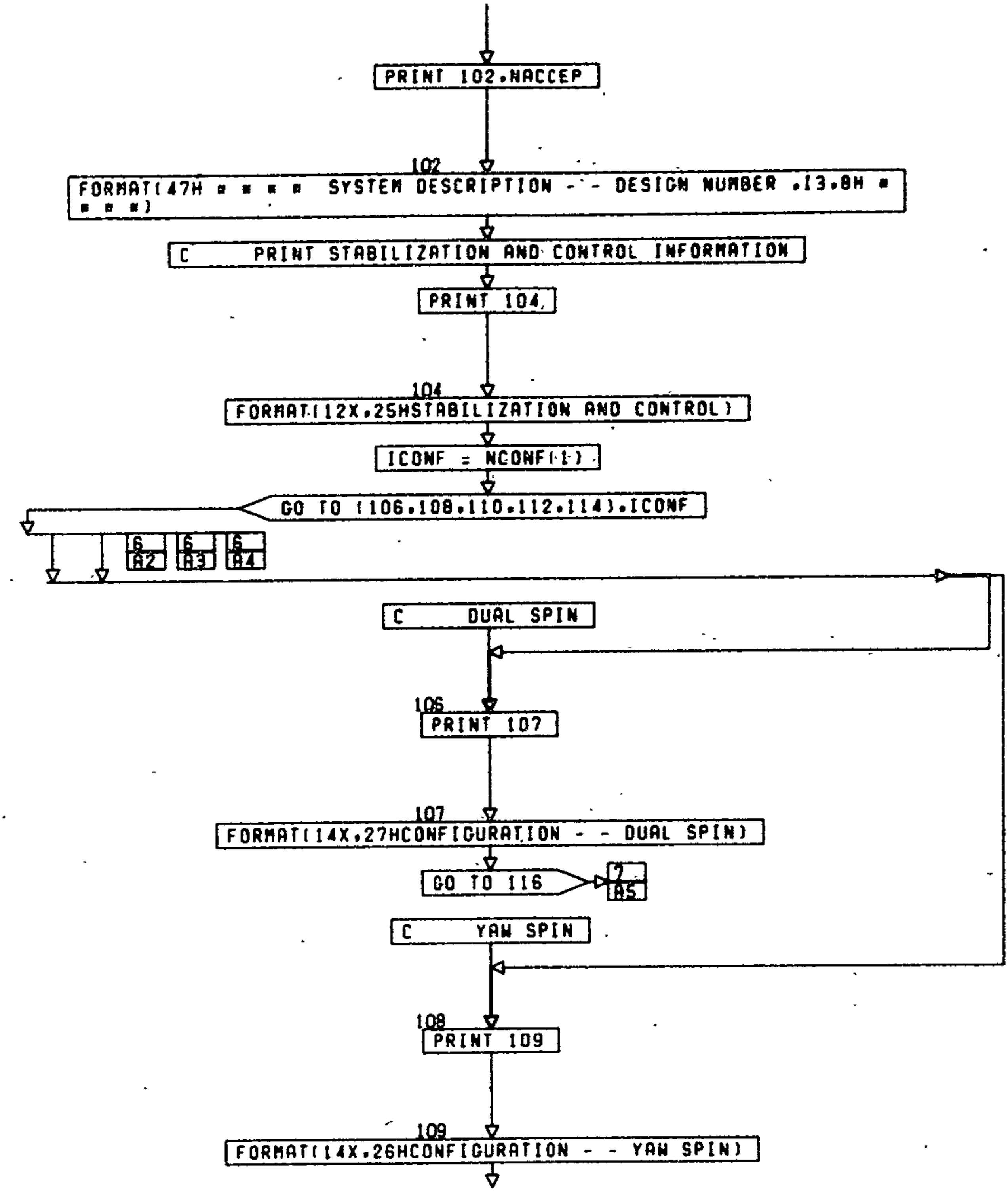
2 A1

```
100
PRINT 9000
```

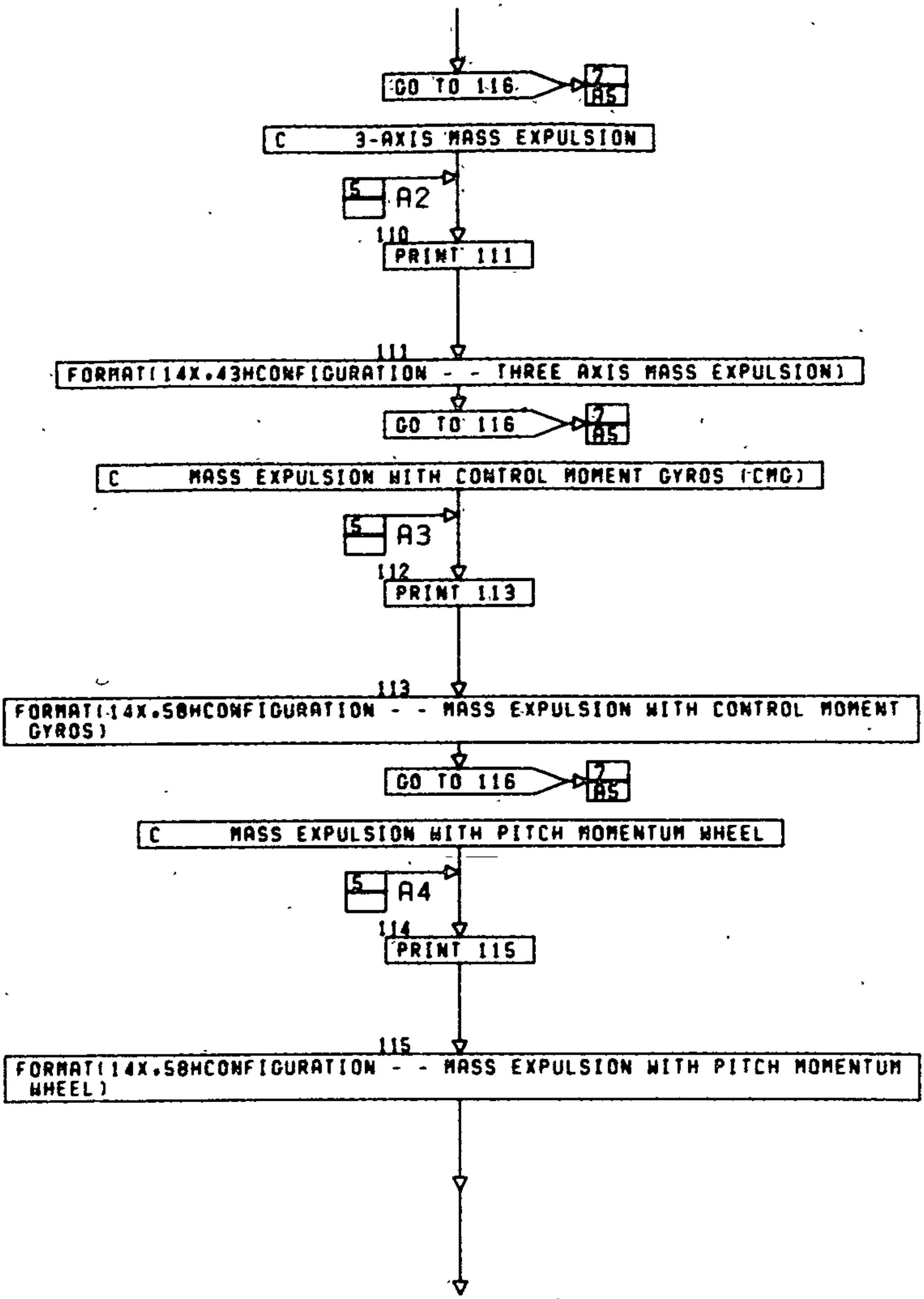
```
PRINT 9999,ITITLE
```

```
9999
FORMAT (10X,13A6)
```

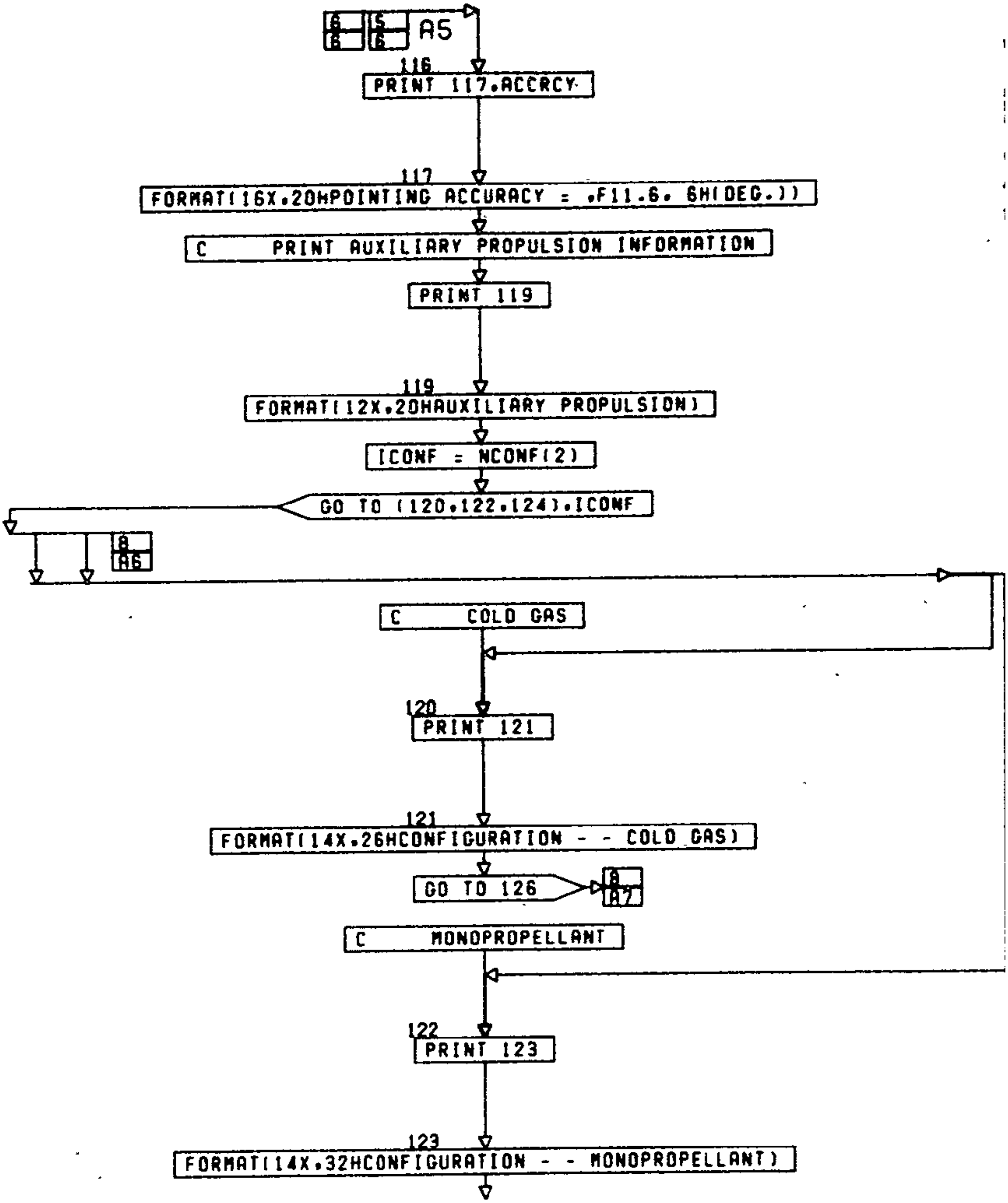
CONT. ON PG 5


PRINT 102,NACCEP
102
FORMAT(47H * * * * SYSTEM DESCRIPTION - - DESIGN NUMBER ,I3,8H * * * *)
C PRINT STABILIZATION AND CONTROL INFORMATION
PRINT 104,
104
FORMAT(12X,25HSTABILIZATION AND CONTROL)
ICONF = NCONF(1)
GO TO (106,108,110,112,114),ICONF
6
A2
6
A3
6
A4
C DUAL SPIN
106
PRINT 107
107
FORMAT(14X,27HCONFIGURATION - - DUAL SPIN)
GO TO 116
7
A5
C YAW SPIN
108
PRINT 109
109
FORMAT(14X,26HCONFIGURATION - - YAW SPIN)

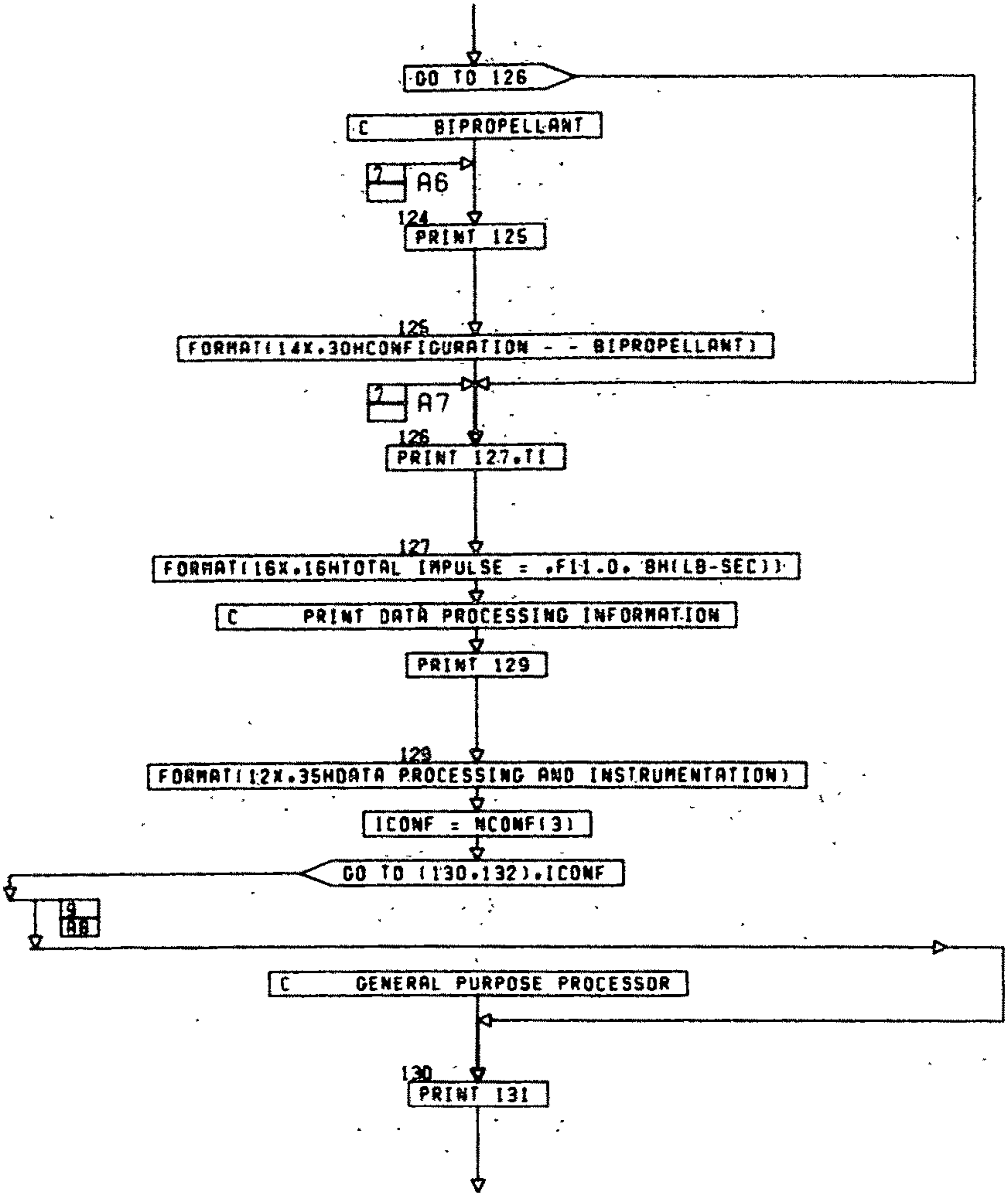
CONT. ON PG 6


GO TO 116
7
A5
C 3-AXIS MASS EXPULSION
5
A2
110
PRINT 111
111
FORMAT(14X,43HCONFIGURATION - - THREE AXIS MASS EXPULSION)
GO TO 116
7
A5
C MASS EXPULSION WITH CONTROL MOMENT GYROS (CMG)
5
A3
112
PRINT 113
113
FORMAT(14X,58HCONFIGURATION - - MASS EXPULSION WITH CONTROL MOMENT GYROS)
GO TO 116
7
A5
C MASS EXPULSION WITH PITCH MOMENTUM WHEEL
5
A4
114
PRINT 115
115
FORMAT(14X,58HCONFIGURATION - - MASS EXPULSION WITH PITCH MOMENTUM WHEEL)

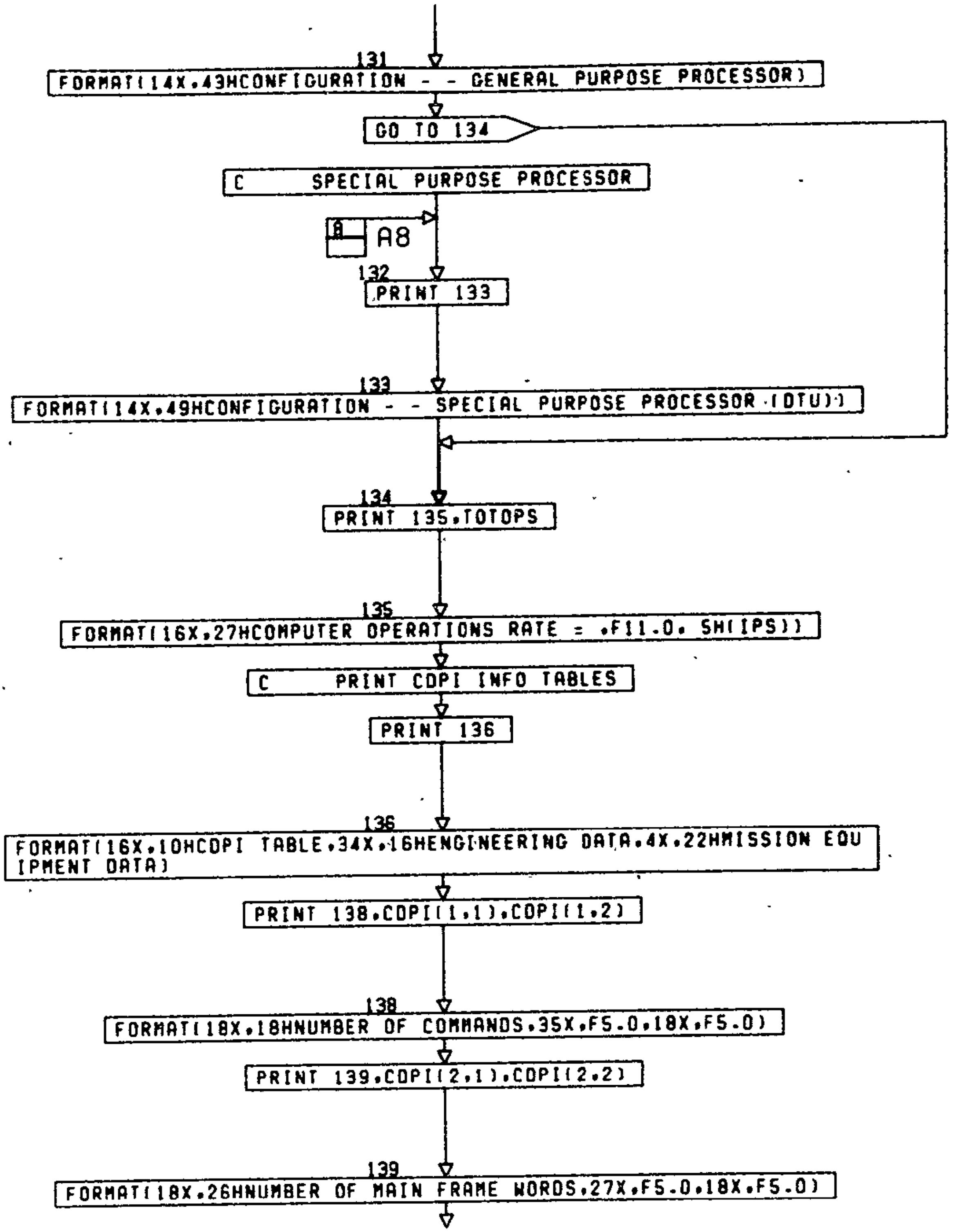
CONT. ON PG 7


6
8
5
6
A5
116
PRINT 117,ACCRCY
117
FORMAT(16X,20HPOINTING ACCURACY = ,F11.6, 6H(DEG.))
C PRINT AUXILIARY PROPULSION INFORMATION
PRINT 119
119
FORMAT(12X,20HAUXILIARY PROPULSION)
ICONF = NCONF(2)
GO TO (120,122,124),ICONF
8
A6
C COLD GAS
120
PRINT 121
121
FORMAT(14X,26HCONFIGURATION - - COLD GAS)
GO TO 126
8
A7
C MONOPROPELLANT
122
PRINT 123
123
FORMAT(14X,32HCONFIGURATION - - MONOPROPELLANT)

CONT. ON PG 8


GO TO 126
C BIPROPELLANT
7
A6
124
PRINT 125
125
FORMAT(14X,30HCONFIGURATION - - BIPROPELLANT)
7
A7
126
PRINT 127,TI
127
FORMAT(16X,16HTOTAL IMPULSE = ,F11.0, 8H(LB-SEC))
C PRINT DATA PROCESSING INFORMATION
PRINT 129
129
FORMAT(12X,35HDATA PROCESSING AND INSTRUMENTATION)
ICONF = NCONF(3)
GO TO (130,132),ICONF
9
A8
C GENERAL PURPOSE PROCESSOR
130
PRINT 131

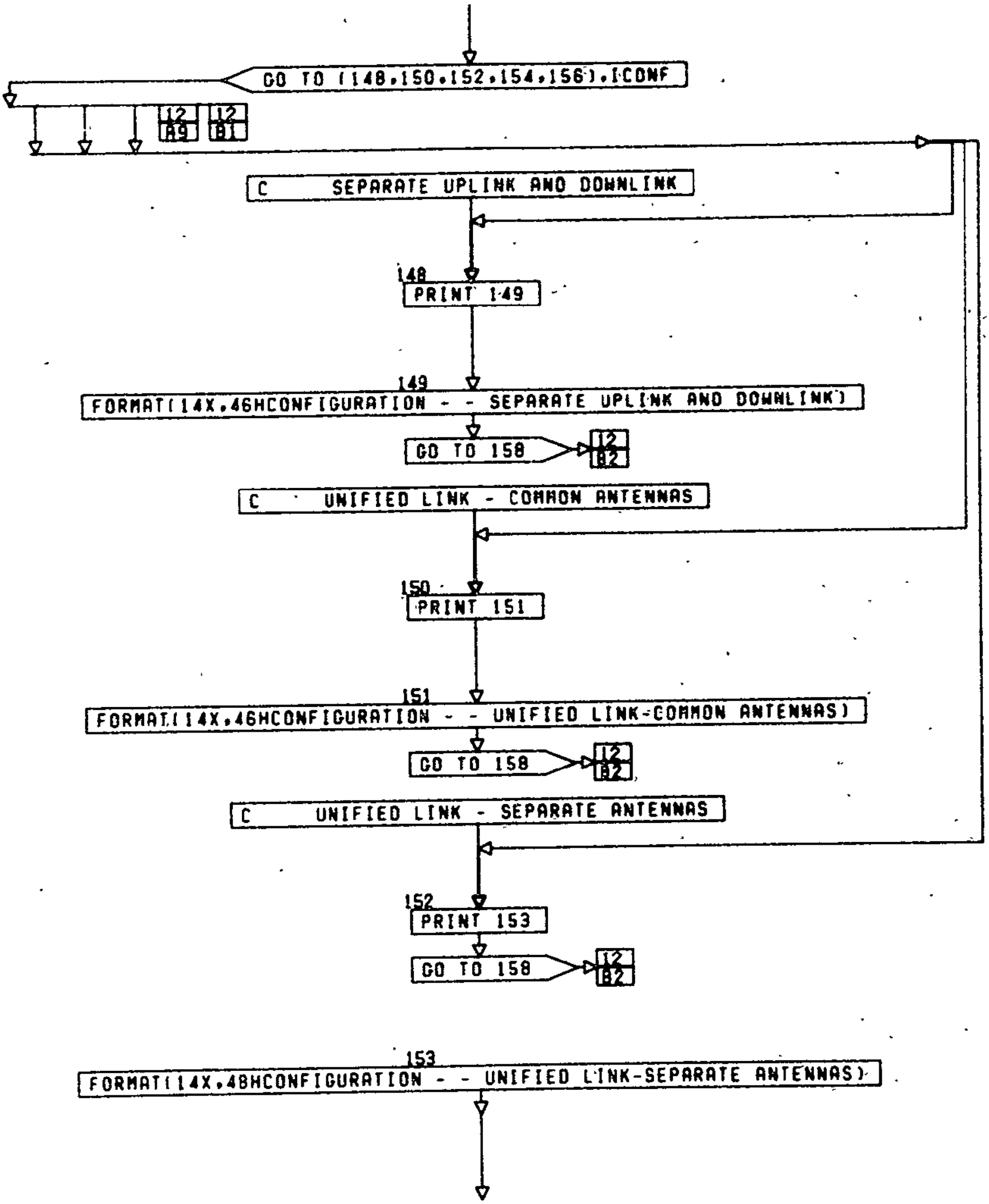
CONT. ON PG 9


131
FORMAT(14X,43HCONFIGURATION - - GENERAL PURPOSE PROCESSOR)
GO TO 134
C SPECIAL PURPOSE PROCESSOR
A
A8
132
PRINT 133
133
FORMAT(14X,49HCONFIGURATION - - SPECIAL PURPOSE PROCESSOR (DTU))
134
PRINT 135,TOTOPS
135
FORMAT(16X,27HCOMPUTER OPERATIONS RATE = ,F11.0, 5H(IPS))
C PRINT COPI INFO TABLES
PRINT 136
136
FORMAT(16X,10HCOPI TABLE,34X,16HENGINEERING DATA,4X,22HMISSION EQU
IPMENT DATA)
PRINT 138,COPI(1,1),COPI(1,2)
138
FORMAT(18X,18HNUMBER OF COMMANDS,35X,F5.0,18X,F5.0)
PRINT 139,COPI(2,1),COPI(2,2)
139
FORMAT(18X,26HNUMBER OF MAIN FRAME WORDS,27X,F5.0,18X,F5.0)

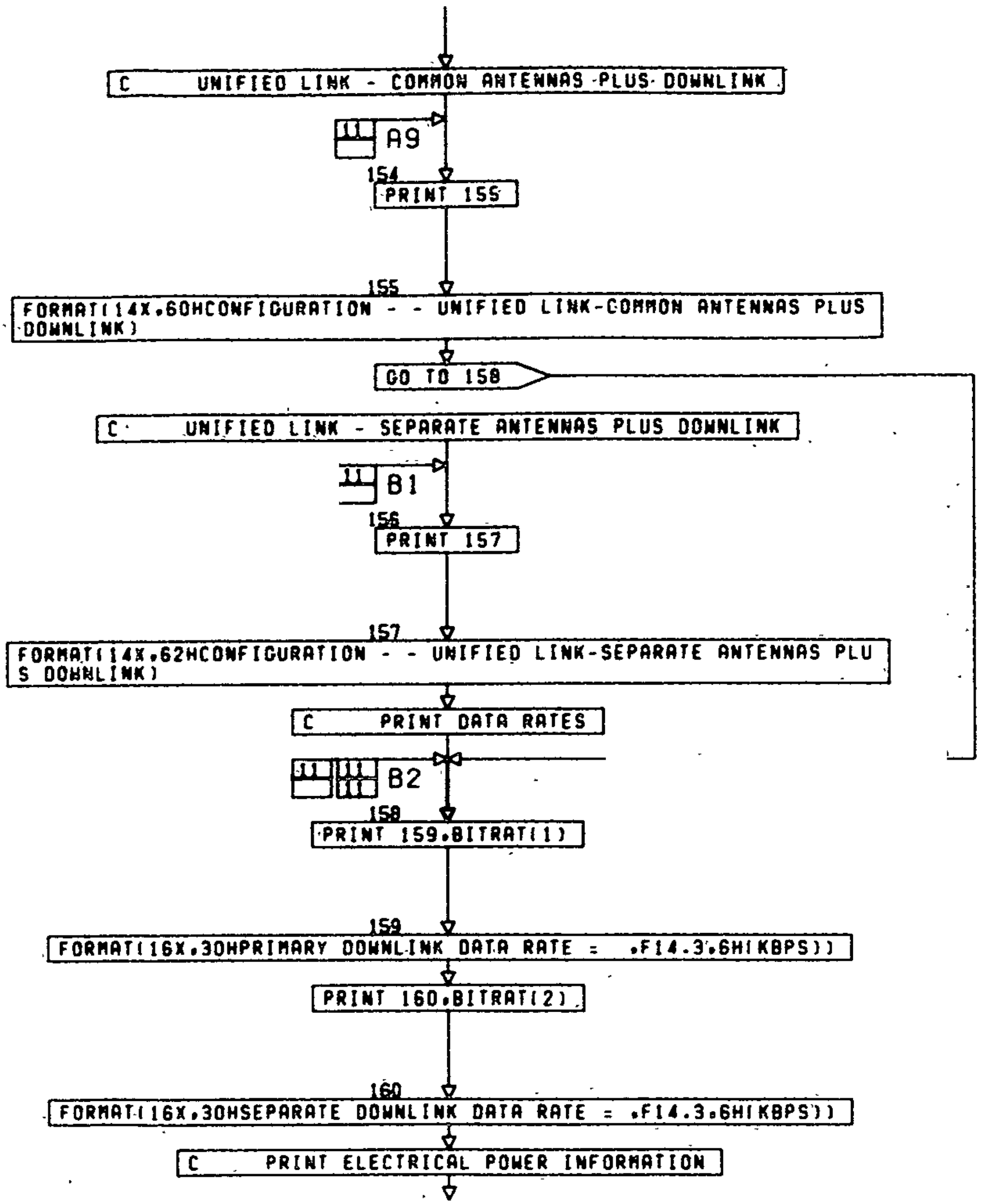
CONT. ON PG 10

```
PRINT 140,COPI(3,1),COPI(3,2)

140
FORMAT(18X,22HMAIN FRAME SAMPLE RATE,25X,F11.0,12X,F11.0)

PRINT 141,COPI(4,1),COPI(4,2)

141
FORMAT(18X,22HMAIN FRAME WORD LENGTH,31X,F5.0,18X,F5.0)

PRINT 142,COPI(5,1),COPI(5,2)

142
FORMAT(18X,19HNUMBER OF SUBFRAMES,34X,F5.0,18X,F5.0)

PRINT 143,COPI(6,1),COPI(6,2)

143
FORMAT(18X,13HSUBFRAME RATE,38X,F11.4,12X,F11.4)

PRINT 144,COPI(7,1),COPI(7,2)

144
FORMAT(18X,28HNUMBER OF WORDS PER SUBFRAME,25X,F5.0,18X,F5.0)

C      PRINT COMMUNICATIONS INFORMATION

PRINT 146

146
FORMAT(12X,14HCOMMUNICATIONS)

ICONF = NCONF(4)
```

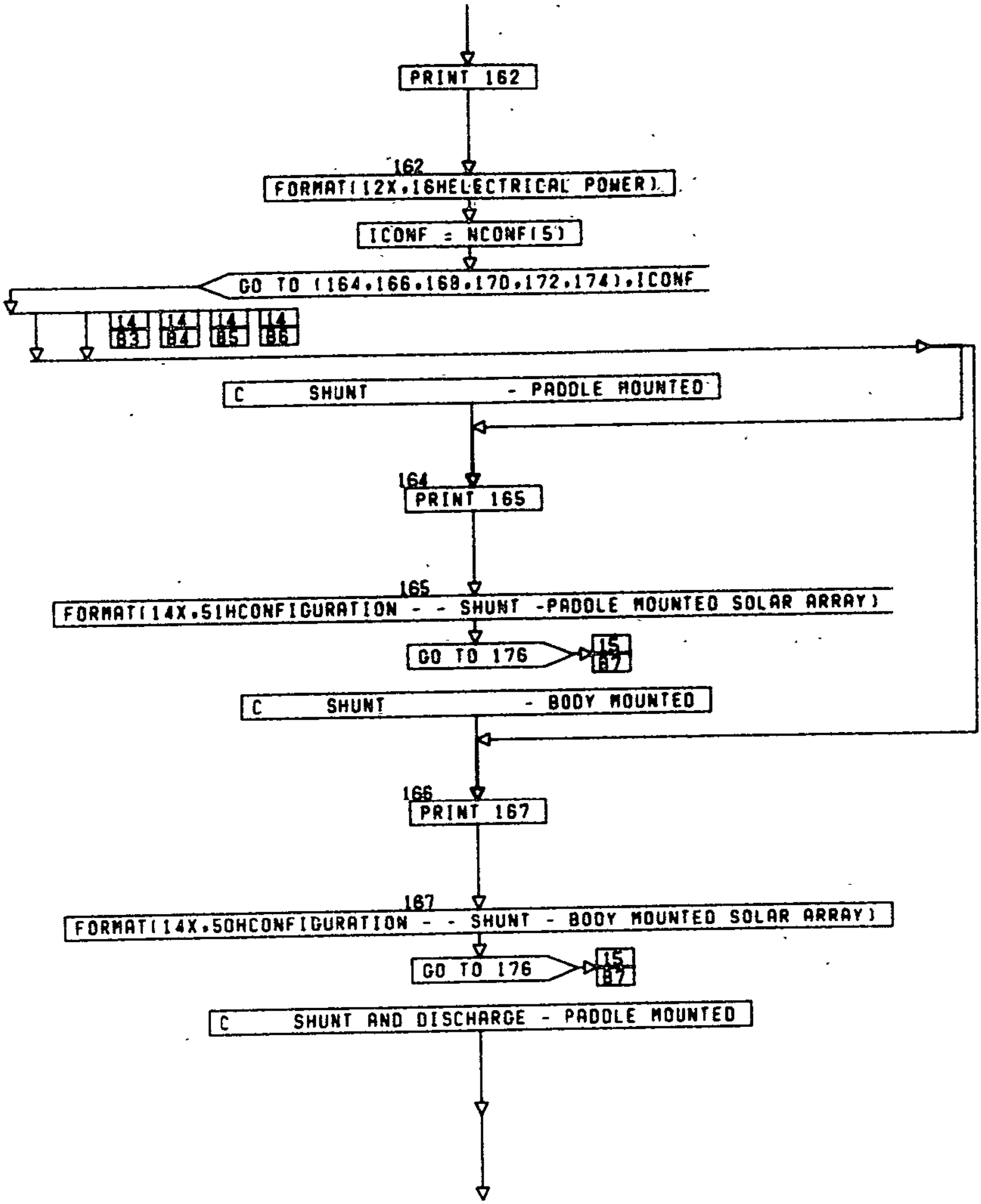
CONT. ON PG 11


GO TO (148,150,152,154,156),ICONF
12 A9
12 B1
C SEPARATE UPLINK AND DOWNLINK
148
PRINT 149
149
FORMAT(14X,46HCONFIGURATION - - SEPARATE UPLINK AND DOWNLINK)
GO TO 158
12 B2
C UNIFIED LINK - COMMON ANTENNAS
150
PRINT 151
151
FORMAT(14X,46HCONFIGURATION - - UNIFIED LINK-COMMON ANTENNAS)
GO TO 158
12 B2
C UNIFIED LINK - SEPARATE ANTENNAS
152
PRINT 153
GO TO 158
12 B2
153
FORMAT(14X,48HCONFIGURATION - - UNIFIED LINK-SEPARATE ANTENNAS)

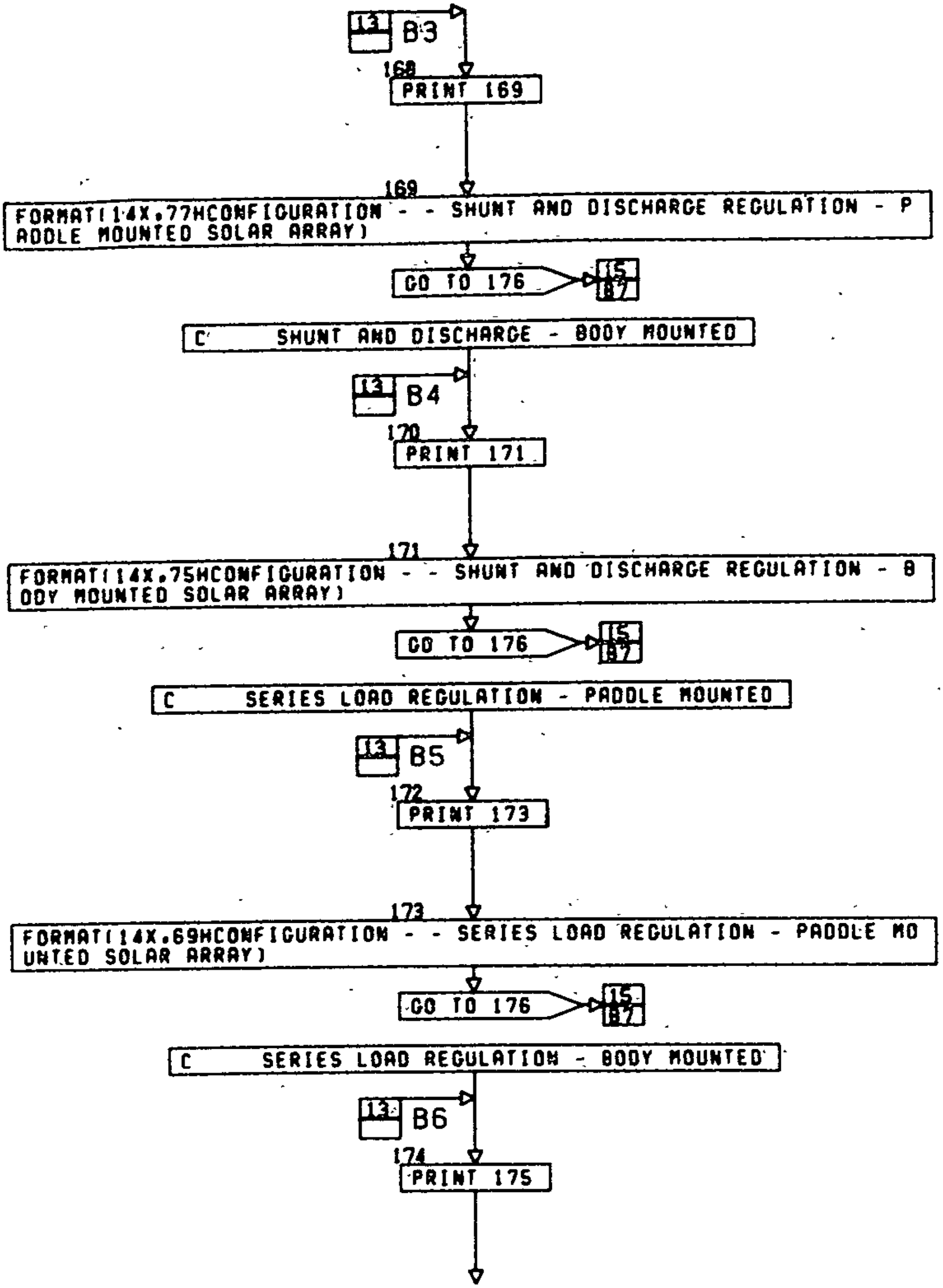
CONT. ON PG 12


C UNIFIED LINK - COMMON ANTENNAS PLUS DOWNLINK
A9
154
PRINT 155
155
FORMAT(14X,60HCONFIGURATION - - UNIFIED LINK-COMMON ANTENNAS PLUS DOWNLINK)
GO TO 158
C UNIFIED LINK - SEPARATE ANTENNAS PLUS DOWNLINK
B1
156
PRINT 157
157
FORMAT(14X,62HCONFIGURATION - - UNIFIED LINK-SEPARATE ANTENNAS PLUS DOWNLINK)
C PRINT DATA RATES
B2
158
PRINT 159,BITRAT(1)
159
FORMAT(16X,30HPRIMARY DOWNLINK DATA RATE = ,F14.3,6H(KBPS))
PRINT 160,BITRAT(2)
160
FORMAT(16X,30HSEPARATE DOWNLINK DATA RATE = ,F14.3,6H(KBPS))
C PRINT ELECTRICAL POWER INFORMATION

CONT. ON PG 13


PRINT 162
162
FORMAT(12X,16HELECTRICAL POWER)
ICONF = NCONF(5)
GO TO (164,166,168,170,172,174),ICONF
14
B3
14
B4
14
B5
14
B6
C SHUNT - PADDLE MOUNTED
164
PRINT 165
165
FORMAT(14X,51HCONFIGURATION - - SHUNT -PADDLE MOUNTED SOLAR ARRAY)
GO TO 176
15
B7
C SHUNT - BODY MOUNTED
166
PRINT 167
167
FORMAT(14X,50HCONFIGURATION - - SHUNT - BODY MOUNTED SOLAR ARRAY)
GO TO 176
15
B7
C SHUNT AND DISCHARGE - PADDLE MOUNTED

CONT. ON PG 14


13
B3
168
PRINT 169
169
FORMAT(14X,77HCONFIGURATION - - SHUNT AND DISCHARGE REGULATION - P
ADDLE MOUNTED SOLAR ARRAY)
GO TO 176
15
B7
C SHUNT AND DISCHARGE - BODY MOUNTED
13
B4
170
PRINT 171
171
FORMAT(14X,75HCONFIGURATION - - SHUNT AND DISCHARGE REGULATION - B
ODY MOUNTED SOLAR ARRAY)
GO TO 176
15
B7
C SERIES LOAD REGULATION - PADDLE MOUNTED
13
B5
172
PRINT 173
173
FORMAT(14X,69HCONFIGURATION - - SERIES LOAD REGULATION - PADDLE MO
UNTED SOLAR ARRAY)
GO TO 176
15
B7
C SERIES LOAD REGULATION - BODY MOUNTED
13
B6
174
PRINT 175

CONT. ON PG 15

175
FORMAT(14X,67HCONFIGURATION - - SERIES LOAD REGULATION - BODY MOUN
TED SOLAR ARRAY)

C PRINT E.P. STATS

14 | 14 14 | 13 13 B7

176
PRINT 177,PL

177
FORMAT(16X,35HEND OF LIFE POWER REQUIREMENT =,F11.2,7H(WATTS))

PRINT 179,AREA

179
FORMAT(16X,22HTOTAL SOLAR ARRAY AREA,12X,1H=,F11.2, 7H(FT**2))

PRINT 181,CISTAR

181
FORMAT(16X,35HMINIMUM INSTALLED BATTERY CAPACITY=,F11.2,8H(AMP-HR)
).

C PRINT VEHICLE SIZING INFORMATION

PRINT 183

183
FORMAT(12X,14HVEHICLE SIZING)

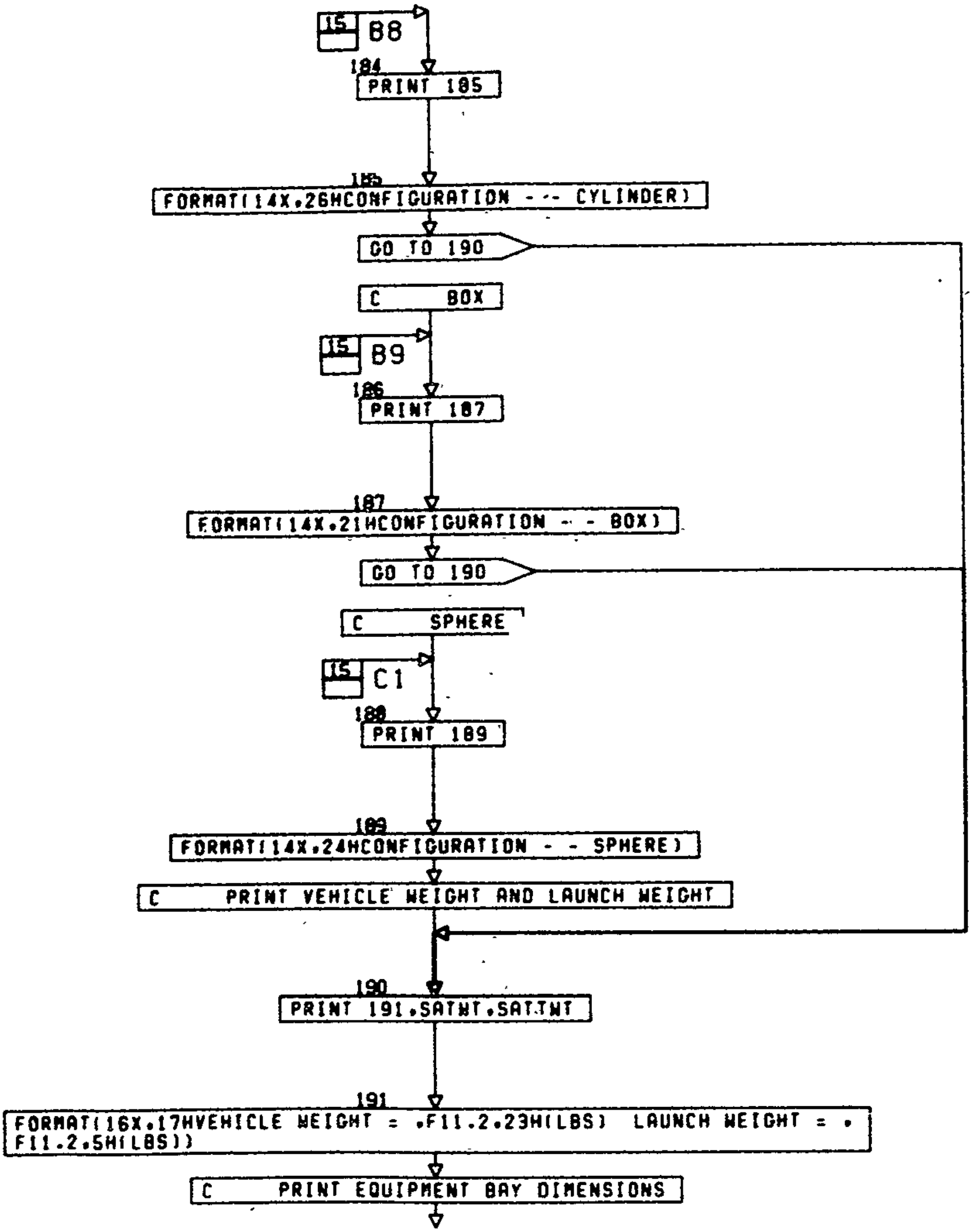
ICONF = NCONF(6)

GO TO (184,186,188),ICONF

16 B8 | 16 B9 | 16 C1

C CYLINDER

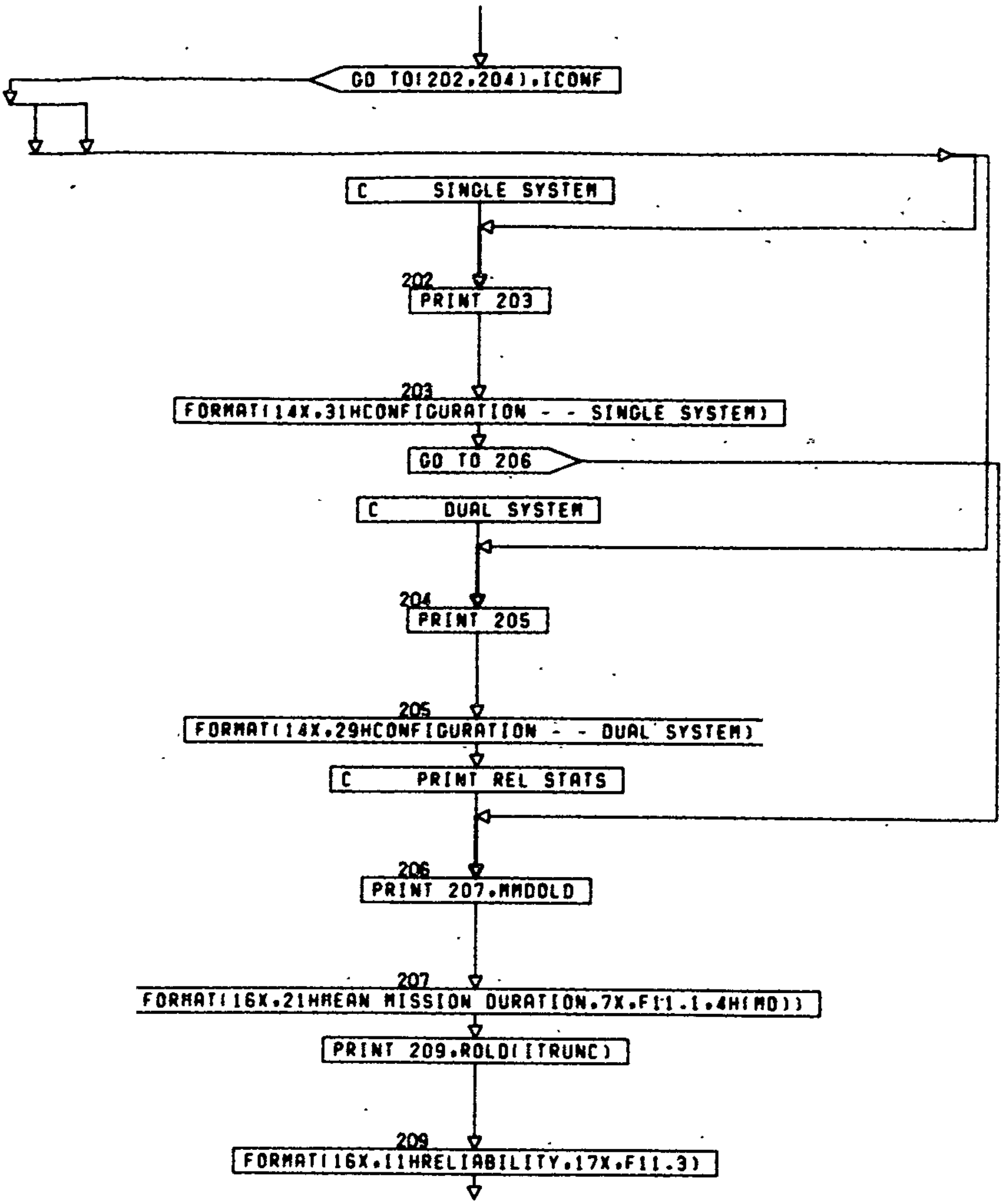
CONT. ON PG 16


15 B8
184
PRINT 185
185
FORMAT(14X,26HCONFIGURATION - -- CYLINDER)
GO TO 190
C BOX
15 B9
186
PRINT 187
187
FORMAT(14X,21HCONFIGURATION - - BOX)
GO TO 190
C SPHERE
15 C1
188
PRINT 189
189
FORMAT(14X,24HCONFIGURATION - - SPHERE)
C PRINT VEHICLE WEIGHT AND LAUNCH WEIGHT
190
PRINT 191,SATWT,SATTWT
191
FORMAT(16X,17HVEHICLE WEIGHT = ,F11.2,23H(LBS) LAUNCH WEIGHT = ,
F11.2,5H(LBS))
C PRINT EQUIPMENT BAY DIMENSIONS

CONT. ON PG 17

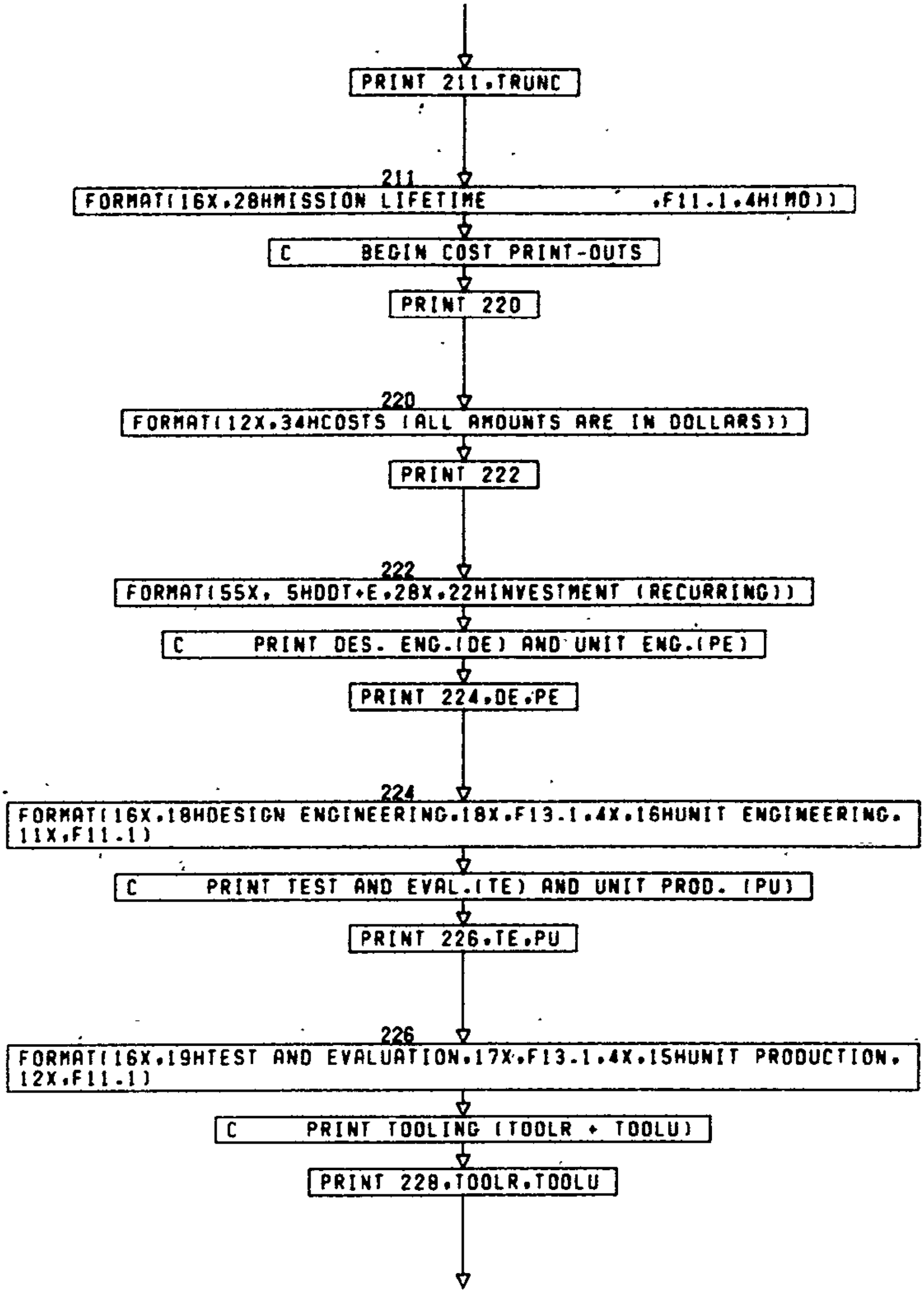
```
PRINT 192,EQBLG,SIDE,SIDE

192 FORMAT(16X,31HEQUIPMENT BAY DIMENSIONS LENGTH,F11.2,11H(IN),HEIGHT
     ,F11.2,10H(IN),WIDTH,F11.2,4H(IN))

C     PRINT MAXIMUM MISSION EQUIPMENT HEIGHT AND WIDTHAND LENGTH

PRINT 193,XMEL,XMEH,XMEW

193 FORMAT(16X,25HMISSION EQUIPMENT LENGTH ,F11.2,12H(IN),HEIGHT ,F11.
     2,12H(IN), WIDTH ,F11.2,4H(IN))

C     PRINT TOTAL SATELLITE LENGTH

PRINT 194,SATLG

194 FORMAT(16X,23HTOTAL SATELLITE LENGTH ,F11.2,4H(IN))

C     PRINT MOMENTS OF INERTIA

PRINT 195,XJ,YJ,ZJ

195 FORMAT(16X,33HMOMENTS OF INERTIA(LB-IN**2) IXX=,F11.1, 5H IYY=,F11
     .1,5H IZZ=,F11.1)

PRINT 9000

C     PRINT SAFETY(RELIABILITY) INFORMATION

PRINT 200

200 FORMAT(12X, 6HSAFETY)

ICONF = IREL + 1
```

CONT. ON PG 18

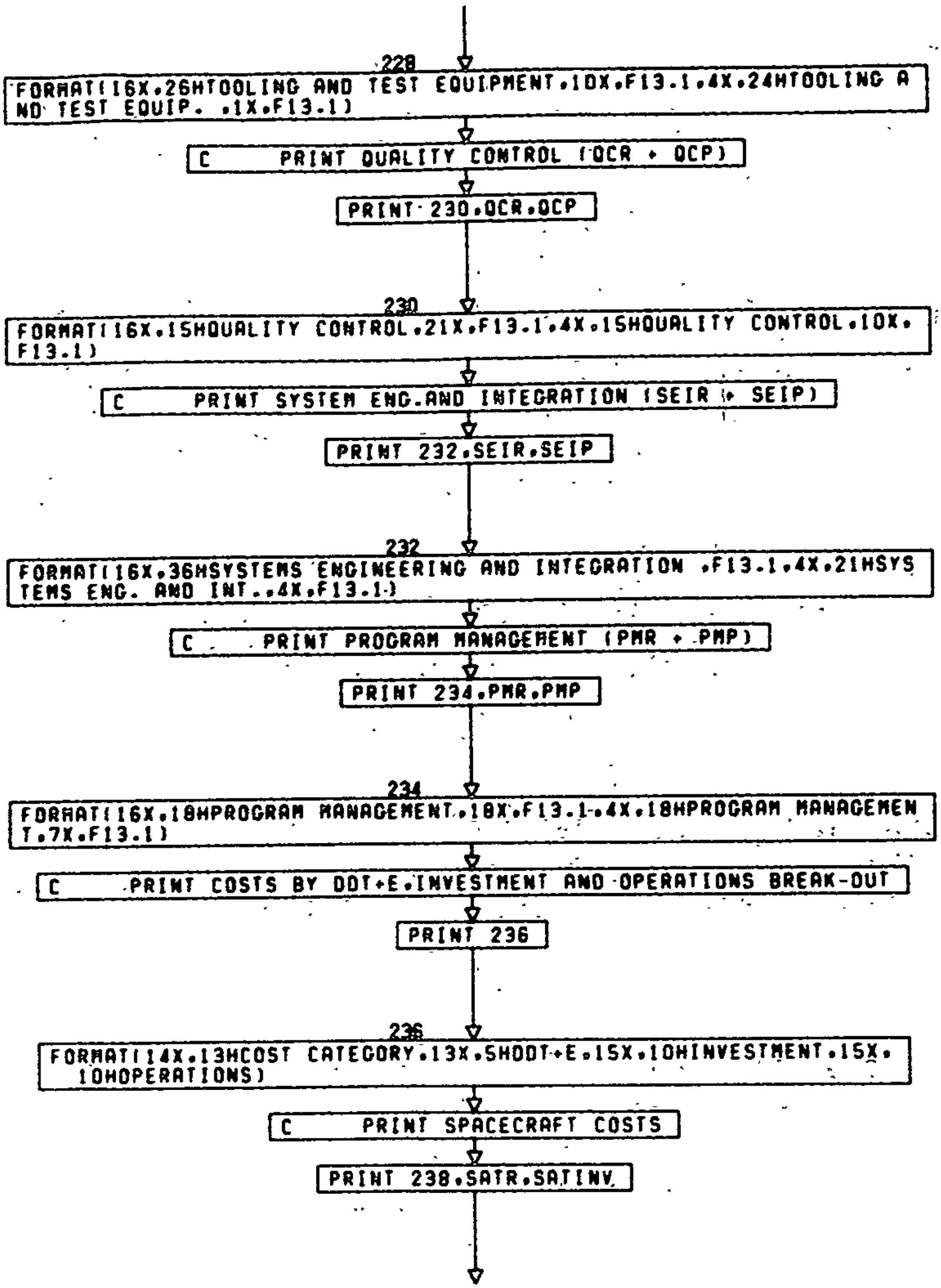


GO TO(202,204),ICONF
C SINGLE SYSTEM
202
PRINT 203
203
FORMAT(14X,31HCONFIGURATION - - SINGLE SYSTEM)
GO TO 206
C DUAL SYSTEM
204
PRINT 205
205
FORMAT(14X,29HCONFIGURATION - - DUAL SYSTEM)
C PRINT REL STATS
206
PRINT 207,MMDOLD
207
FORMAT(16X,21HMEAN MISSION DURATION,7X,F11.1,4H(MD))
PRINT 209,ROLD(ITRUNC)
209
FORMAT(16X,11HRELIABILITY,17X,F11.3)

CONT. ON PG 19


PRINT 211,TRUNC
211
FORMAT(16X,28HMISSION LIFETIME ,F11.1,4H(MO))
C BEGIN COST PRINT-OUTS
PRINT 220
220
FORMAT(12X,34HCOSTS (ALL AMOUNTS ARE IN DOLLARS))
PRINT 222
222
FORMAT(55X, 5HDDT+E,28X,22HINVESTMENT (RECURRING))
C PRINT DES. ENG.(DE) AND UNIT ENG.(PE)
PRINT 224,DE,PE
224
FORMAT(16X,18HDESIGN ENGINEERING,18X,F13.1,4X,16HUNIT ENGINEERING,
11X,F11.1)
C PRINT TEST AND EVAL.(TE) AND UNIT PROD. (PU)
PRINT 226,TE,PU
226
FORMAT(16X,19HTEST AND EVALUATION,17X,F13.1,4X,15HUNIT PRODUCTION,
12X,F11.1)
C PRINT TOOLING (TOOLR + TOOLU)
PRINT 228,TOOLR,TOOLU

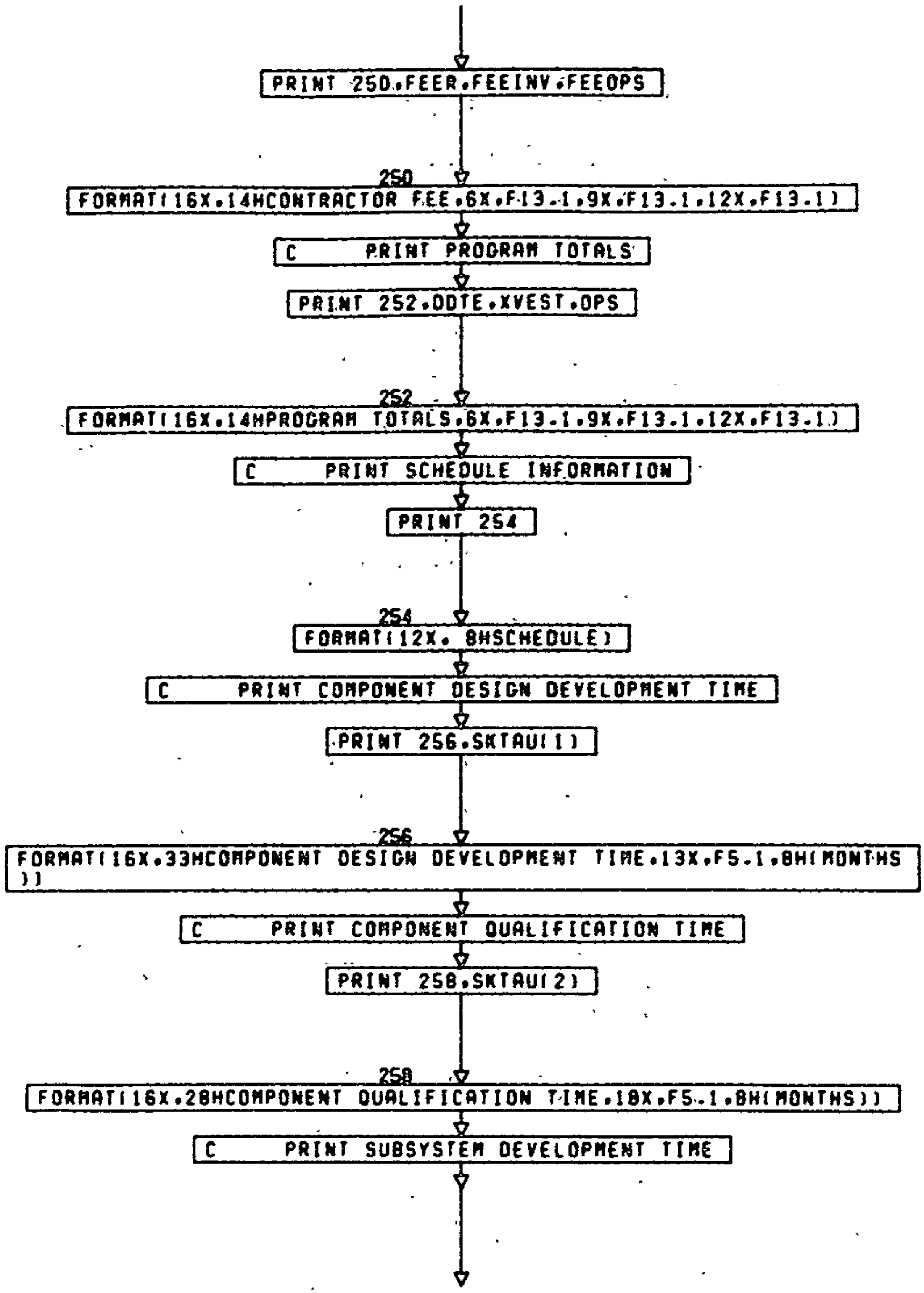
CONT. ON PG 20


228
FORMAT(16X,26HTOOLING AND TEST EQUIPMENT,10X,F13.1,4X,24HTOOLING A
ND TEST EQUIP. ,1X,F13.1)
C PRINT QUALITY CONTROL (QCR + QCP)
PRINT 230,QCR,QCP
230
FORMAT(16X,15HQUALITY CONTROL,21X,F13.1,4X,15HQUALITY CONTROL,10X,
F13.1)
C PRINT SYSTEM ENG.AND INTEGRATION (SEIR + SEIP)
PRINT 232,SEIR,SEIP
232
FORMAT(16X,36HSYSTEMS ENGINEERING AND INTEGRATION ,F13.1,4X,21HSYS
TEMS ENG. AND INT.,4X,F13.1)
C PRINT PROGRAM MANAGEMENT (PMR + PMP)
PRINT 234,PMR,PMP
234
FORMAT(16X,18HPROGRAM MANAGEMENT,18X,F13.1,4X,18HPROGRAM MANAGEMEN
T,7X,F13.1)
C PRINT COSTS BY DDT+E,INVESTMENT AND OPERATIONS BREAK-OUT
PRINT 236
236
FORMAT(14X,13HCOST CATEGORY,13X,5HDDT+E,15X,10HINVESTMENT,15X,
10HOPERATIONS)
C PRINT SPACECRAFT COSTS
PRINT 238,SATR,SATINV

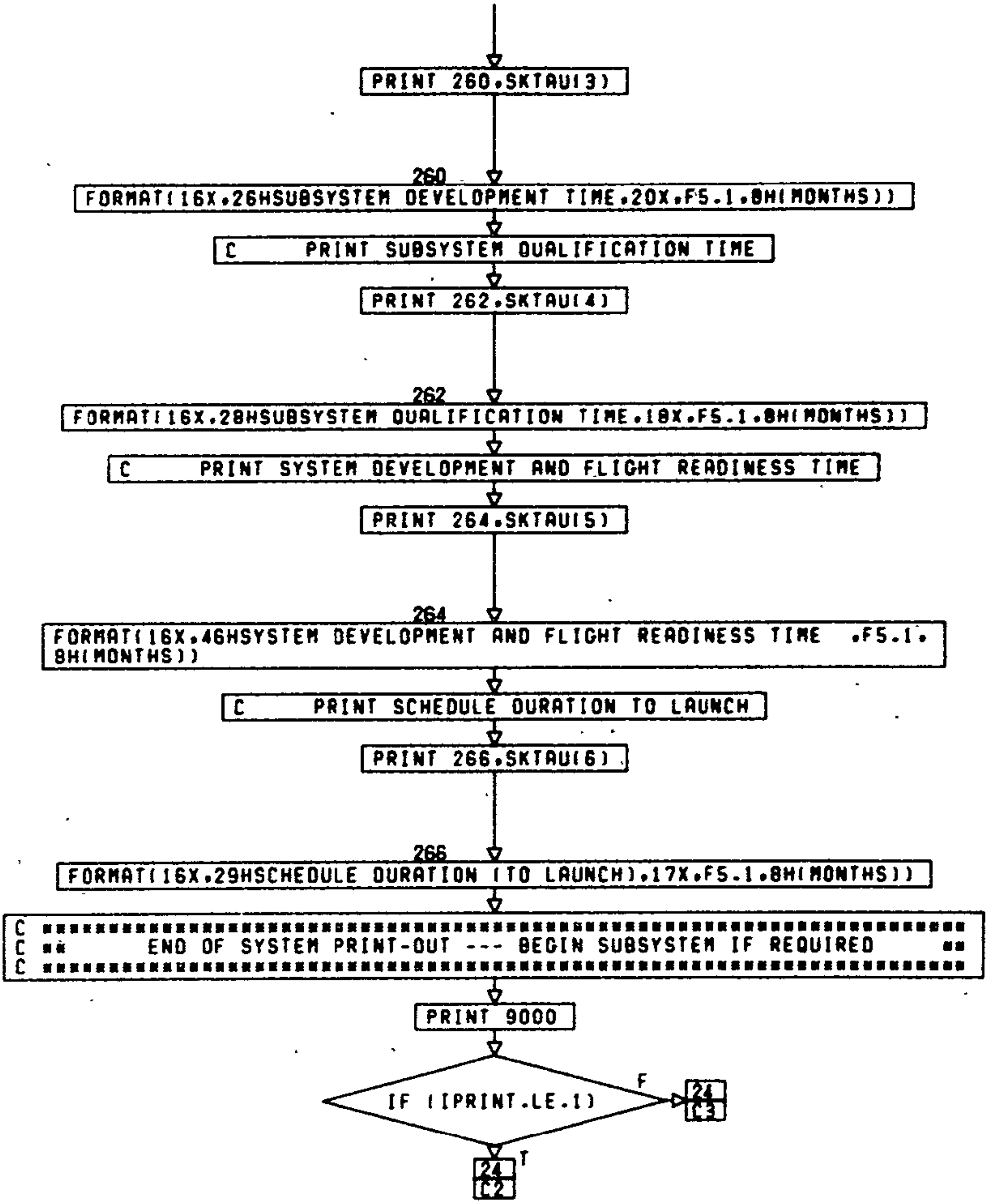
CONT. ON PG 21

```
238
FORMAT(16X,10HSPACECRAFT,10X,F13.1,9X,F13.1)
C       PRINT MISSION EQUIPMENT COSTS
PRINT 240,XMER,XMEINV

240
FORMAT(16X,17HMISSION EQUIPMENT,3X,F13.1,9X,F13.1)
C       PRINT TOTAL PAYLOAD COSTS (SUM OF PRECEDING TWO)
PRINT 242,PAYR,PAYINV

242
FORMAT(16X,13HTOTAL PAYLOAD,7X,F13.1,9X,F13.1)
C       PRINT QUALIFICATION UNITS COST
PRINT 244,PAYQUL

244
FORMAT(16X,20HQUALIFICATION UNITS ,F13.1)
C       PRINT GSE
PRINT 246,GSE

246
FORMAT(16X, 6HG.S.E.,14X,F13.1)
C       PRINT LAUNCH SUPPORT
PRINT 248,XLTOT

248
FORMAT(16X,14HLAUNCH SUPPORT,53X,F13.1)
C       PRINT CONTRACTOR FEE
```

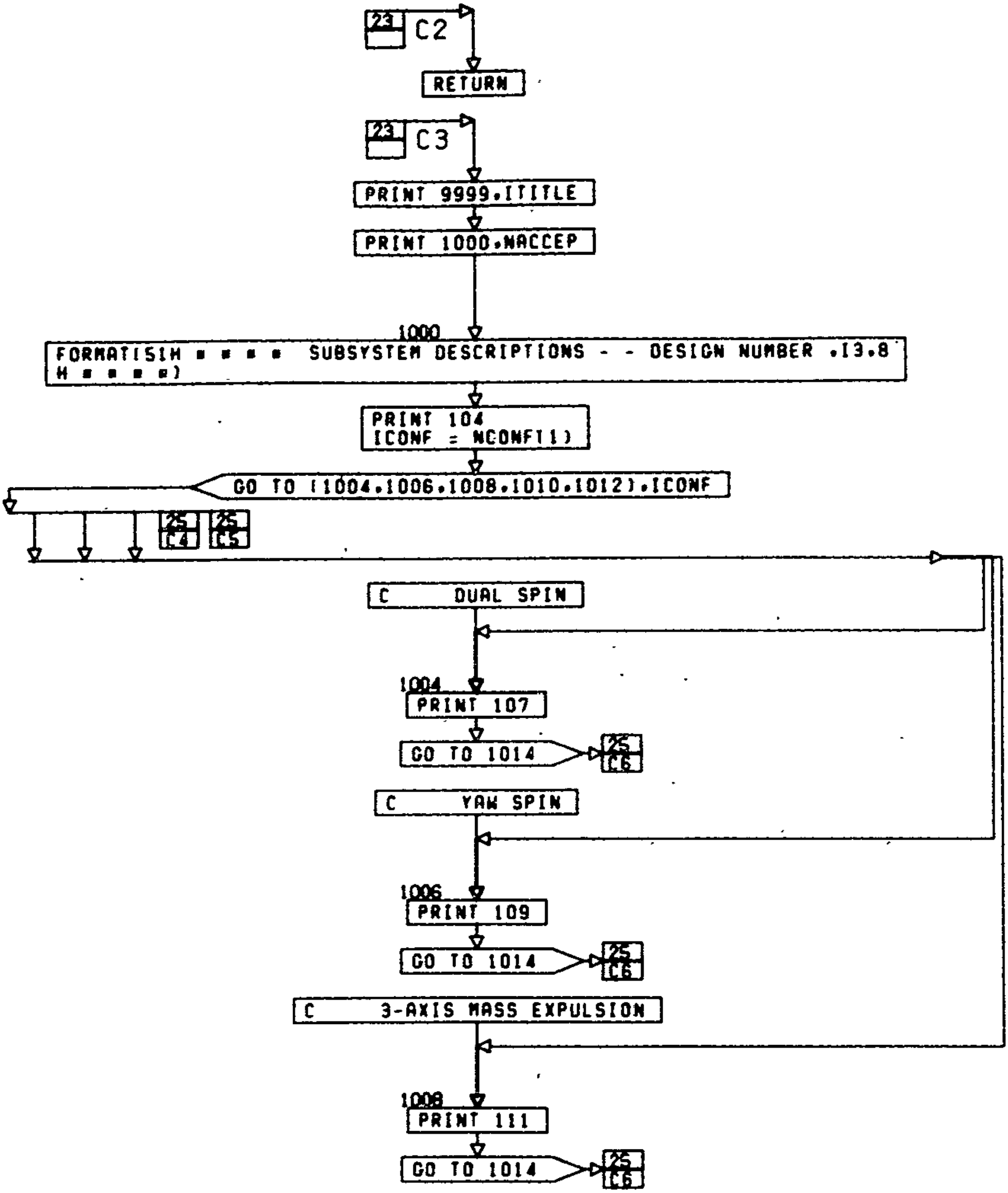
CONT. ON PG 22


PRINT 250,FEER,FEEINV,FEEOPS
250
FORMAT(16X,14HCONTRACTOR FEE,6X,F13.1,9X,F13.1,12X,F13.1)
C PRINT PROGRAM TOTALS
PRINT 252,DDTE,XVEST,OPS
252
FORMAT(16X,14HPROGRAM TOTALS,6X,F13.1,9X,F13.1,12X,F13.1)
C PRINT SCHEDULE INFORMATION
PRINT 254
254
FORMAT(12X, 8HSCHEDULE)
C PRINT COMPONENT DESIGN DEVELOPMENT TIME
PRINT 256,SKTAU(1)
256
FORMAT(16X,33HCOMPONENT DESIGN DEVELOPMENT TIME,13X,F5.1,8H(MONTHS))
C PRINT COMPONENT QUALIFICATION TIME
PRINT 258,SKTAU(2)
258
FORMAT(16X,28HCOMPONENT QUALIFICATION TIME,18X,F5.1,8H(MONTHS))
C PRINT SUBSYSTEM DEVELOPMENT TIME

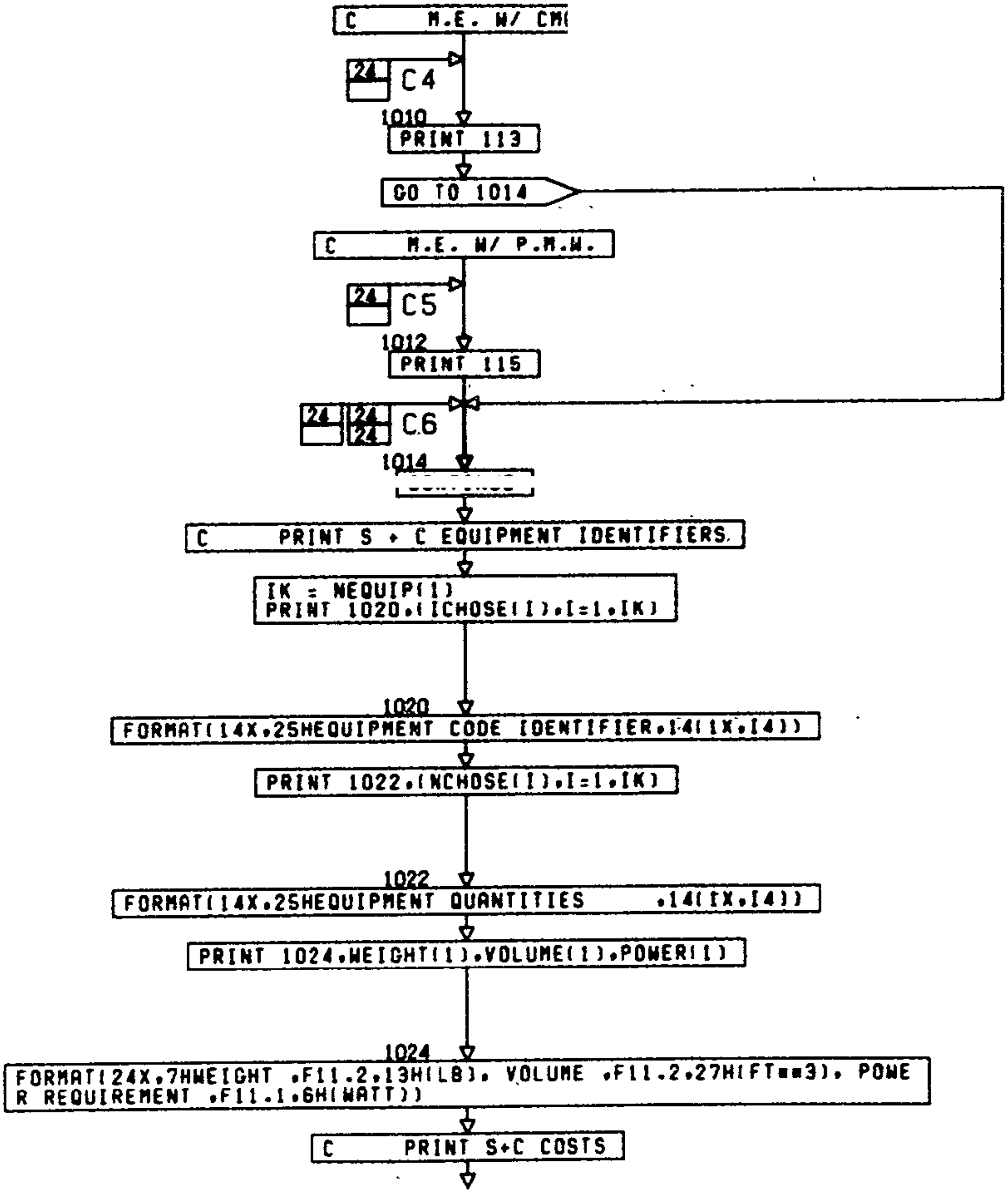
CONT. ON PG 23


PRINT 260,SKTAU(3)
260
FORMAT(16X,26HSUBSYSTEM DEVELOPMENT TIME,20X,F5.1,8H(MONTHS))
C PRINT SUBSYSTEM QUALIFICATION TIME
PRINT 262,SKTAU(4)
262
FORMAT(16X,28HSUBSYSTEM QUALIFICATION TIME,18X,F5.1,8H(MONTHS))
C PRINT SYSTEM DEVELOPMENT AND FLIGHT READINESS TIME
PRINT 264,SKTAU(5)
264
FORMAT(16X,46HSYSTEM DEVELOPMENT AND FLIGHT READINESS TIME ,F5.1,
8H(MONTHS))
C PRINT SCHEDULE DURATION TO LAUNCH
PRINT 266,SKTAU(6)
266
FORMAT(16X,29HSCHEDULE DURATION (TO LAUNCH),17X,F5.1,8H(MONTHS))
C **
C ** END OF SYSTEM PRINT-OUT --- BEGIN SUBSYSTEM IF REQUIRED **
C **
PRINT 9000
IF (IPRINT.LE.1)
F
24
C3
T
24
C2

CONT. ON PG 24


23
C2
RETURN
23
C3
PRINT 9999,ITITLE
PRINT 1000,NACCEP
1000
FORMAT(51H * * * * SUBSYSTEM DESCRIPTIONS - - DESIGN NUMBER ,I3,8
H * * * *)
PRINT 104
ICONF = NCONF(1)
GO TO (1004,1006,1008,1010,1012),ICONF
25
C4
25
C5
C DUAL SPIN
1004
PRINT 107
GO TO 1014
25
C6
C YAW SPIN
1006
PRINT 109
GO TO 1014
25
C6
C 3-AXIS MASS EXPULSION
1008
PRINT 111
GO TO 1014
25
C6

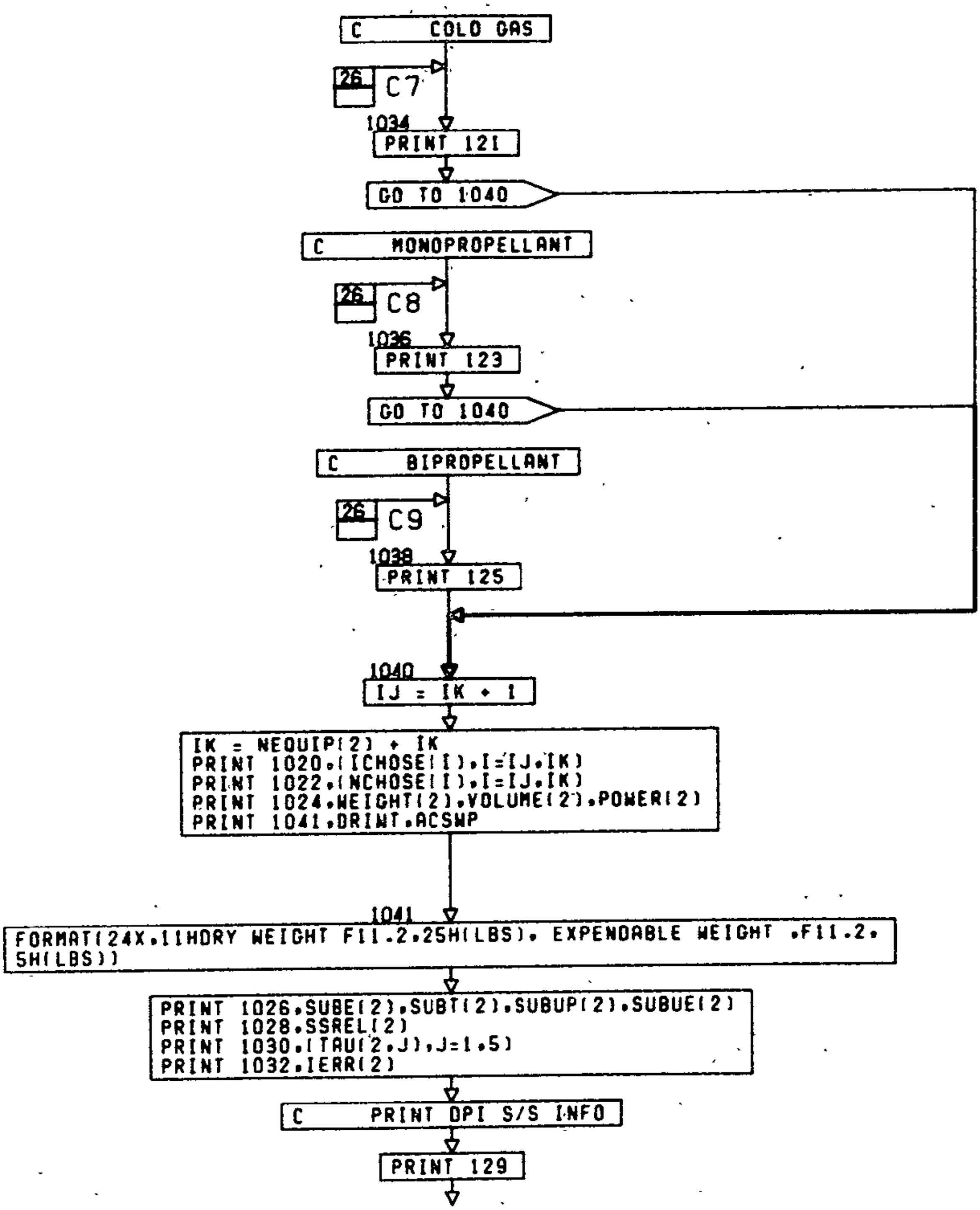
CONT. ON PG 25


C M.E. W/ CM(
24
C4
1010
PRINT 113
GO TO 1014
C M.E. W/ P.M.W.
24
C5
1012
PRINT 115
24
24
24
C6
1014
C PRINT S + C EQUIPMENT IDENTIFIERS.
IK = NEQUIP(1)
PRINT 1020,(ICHOSE(I),I=1,IK)
1020
FORMAT(14X,25HEQUIPMENT CODE IDENTIFIER,14(1X,I4))
PRINT 1022,(NCHOSE(I),I=1,IK)
1022
FORMAT(14X,25HEQUIPMENT QUANTITIES ,14(1X,I4))
PRINT 1024,WEIGHT(1),VOLUME(1),POWER(1)
1024
FORMAT(24X,7HWEIGHT ,F11.2,13H(LB), VOLUME ,F11.2,27H(FT**3), POWE
R REQUIREMENT ,F11.1,6H(WATT))
C PRINT S+C COSTS

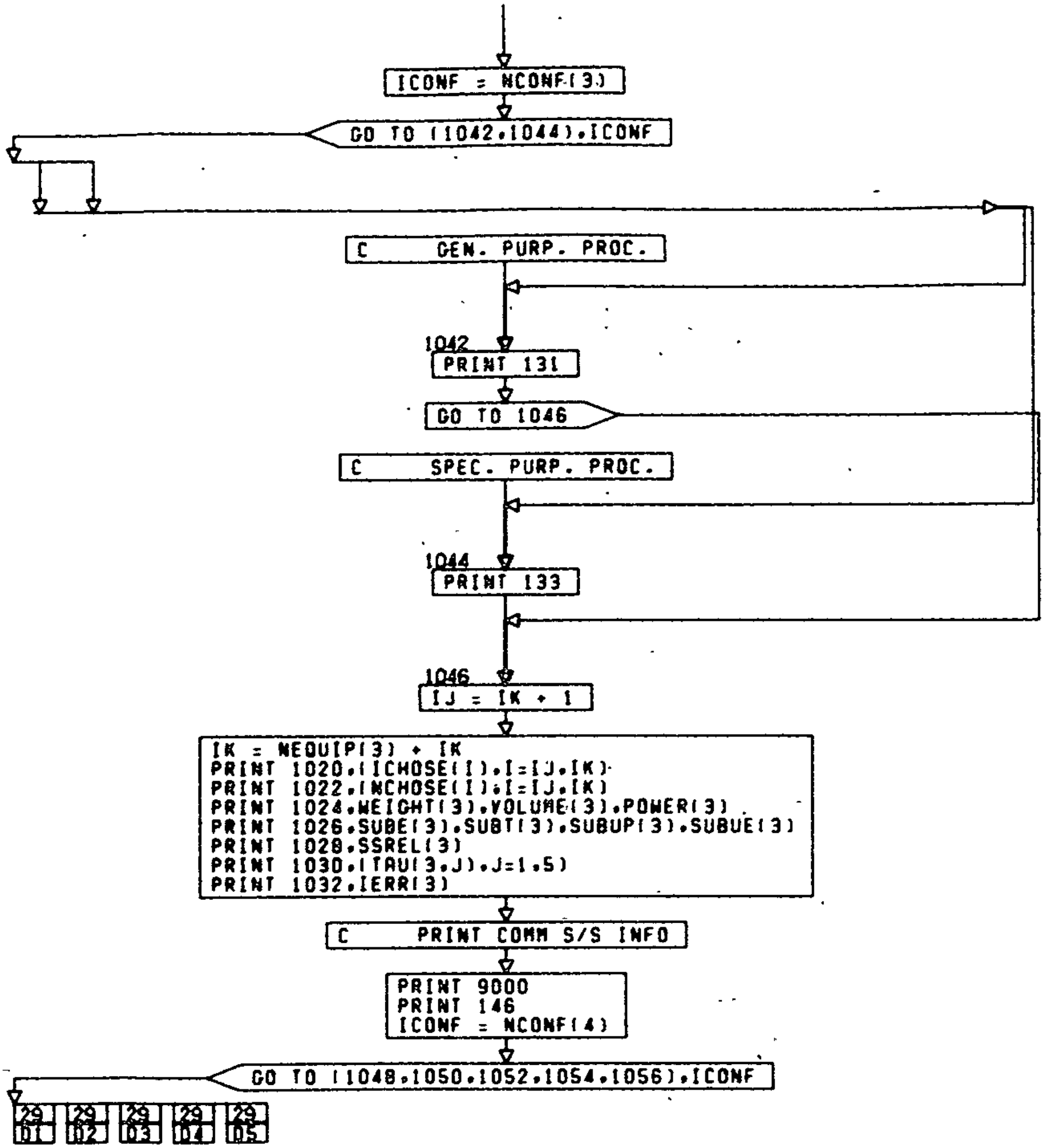
CONT. ON PG 26

```
PRINT 1026,SUBE(1),SUBT(1),SUBUP(1),SUBUE(1)

1026
FORMAT(24X,16HDES. ENG. COST  ,F11.1,10X,17HTEST + EVAL. COST,4X,F
11.1,/,24X,16HUNIT PROD.COST  ,F11.1,10X,17HUNIT ENG.    COST,4X,F
11.1)

C     PRINT S+C REL

PRINT 1028,SSREL(1)

1028
FORMAT(24X,11HRELIABILITY,5X,F11.4)

C     PRINT S+C SCHEDULE
C     PRINT S+C SCHEDULE

PRINT 1030,(TAU(1,J),J=1,5)

1030
FORMAT(24X, 8HSCHEDULE,/,26X,27HCOMPONENT DEVELOPMENT TIME ,F5.1,3
7H(MONTH) COMPONENT QUALIFICATION TIME ,F5.1,7H(MONTH),/,26X,27HSU
BSYSTEM DEVELOPMENT TIME ,F5.1,37H(MONTH) SUBSYSTEM QUALIFICATION
TIME ,F5.1,7H(MONTH),/,26X,45HSYSTEM DEVELOPMENT AND FLIGHT READIN
ESS TIME ,F5.1,7H(MONTH))

PRINT 1032,IERR(1)

1032
FORMAT(24X,4HIERR,5X,I10)

C     PRINT A.P. SUBSYSTEM INFO

PRINT 119
ICONF = NCONF(2)

GO TO (1034,1036,1038),ICONF

27  27  27
C7  C8  C9
```

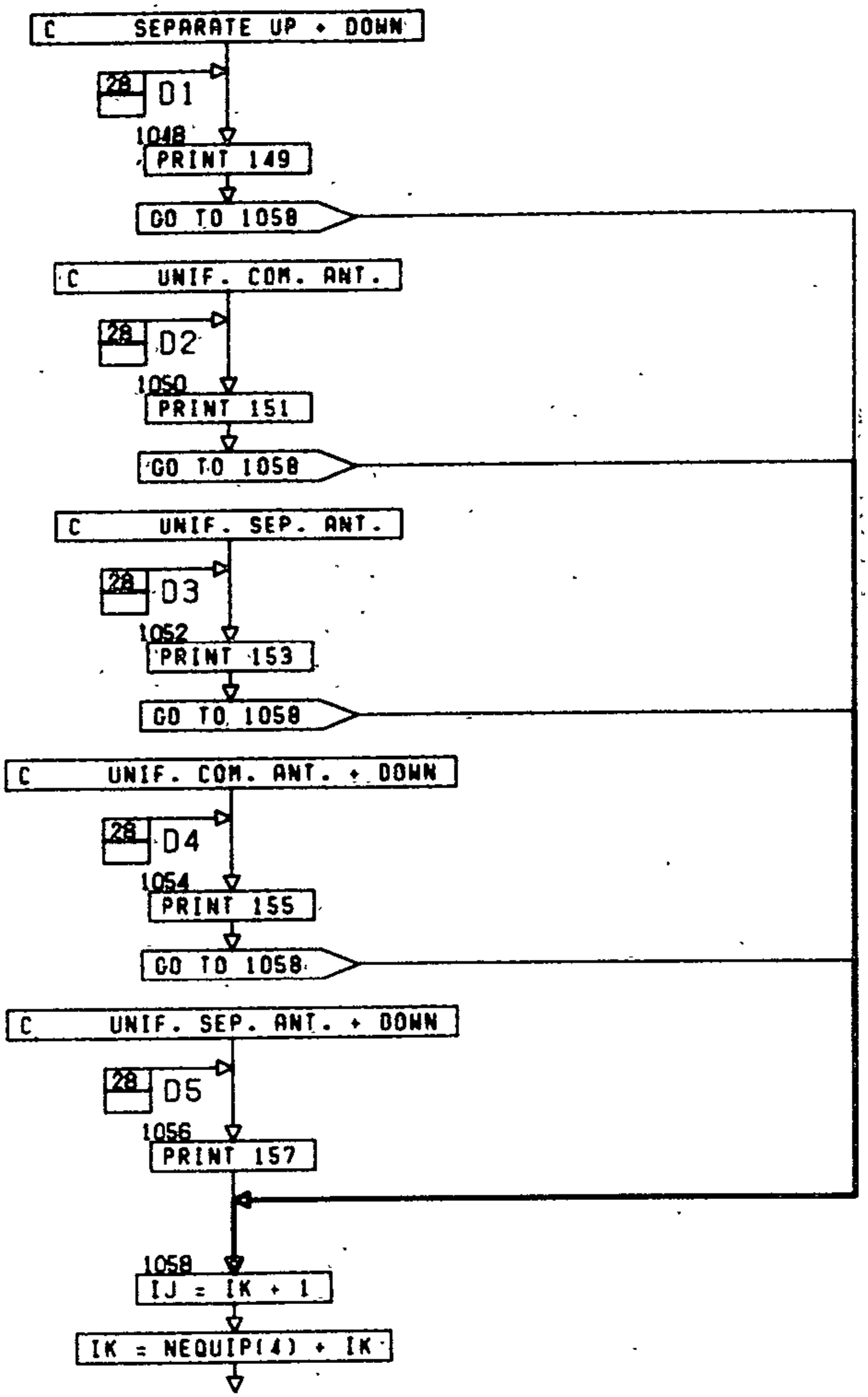
CONT. ON PG 27


C COLD GAS
26
C7
1034
PRINT 121
GO TO 1040
C MONOPROPELLANT
26
C8
1036
PRINT 123
GO TO 1040
C BIPROPELLANT
26
C9
1038
PRINT 125
1040
IJ = IK + 1
IK = NEQUIP(2) + IK
PRINT 1020,(ICHOSE(I),I=IJ,IK)
PRINT 1022,(NCHOSE(I),I=IJ,IK)
PRINT 1024,WEIGHT(2),VOLUME(2),POWER(2)
PRINT 1041,DRINT,ACSWP
1041
FORMAT(24X,11HDRY WEIGHT F11.2,25H(LBS), EXPENDABLE WEIGHT ,F11.2,
5H(LBS))
PRINT 1026,SUBE(2),SUBT(2),SUBUP(2),SUBUE(2)
PRINT 1028,SSREL(2)
PRINT 1030,(TAU(2,J),J=1,5)
PRINT 1032,IERR(2)
C PRINT DPI S/S INFO
PRINT 129

CONT. ON PG 28

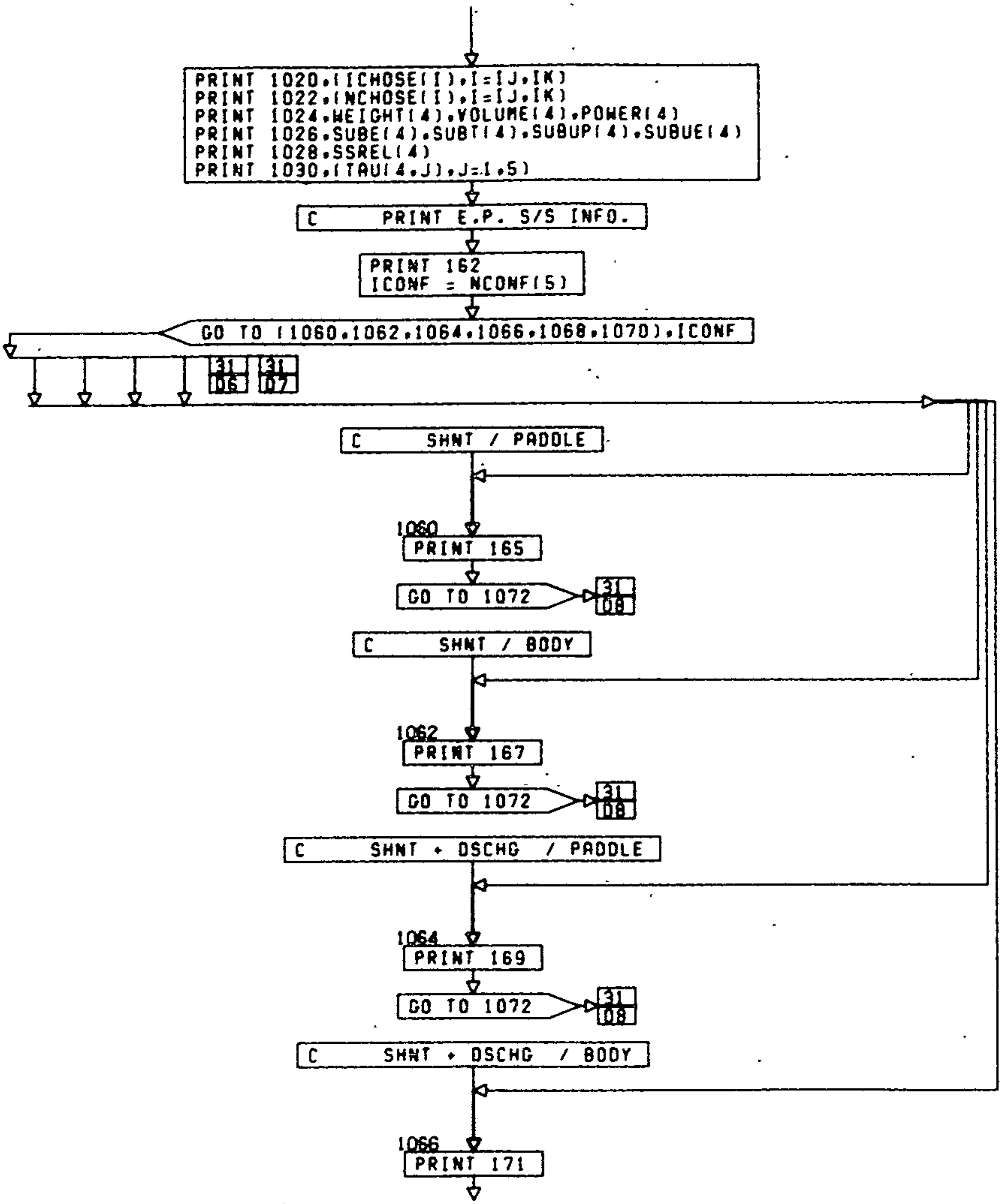

ICONF = NCONF(3)
GO TO (1042,1044),ICONF
C GEN. PURP. PROC.
1042
PRINT 131
GO TO 1046
C SPEC. PURP. PROC.
1044
PRINT 133
1046
IJ = IK + 1
IK = NEQUIP(3) + IK
PRINT 1020,(ICHOSE(I),I=IJ,IK)
PRINT 1022,(NCHOSE(I),I=IJ,IK)
PRINT 1024,WEIGHT(3),VOLUME(3),POWER(3)
PRINT 1026,SUBE(3),SUBT(3),SUBUP(3),SUBUE(3)
PRINT 1028,SSREL(3)
PRINT 1030,(TAU(3,J),J=1,5)
PRINT 1032,IERR(3)
C PRINT COMM S/S INFO
PRINT 9000
PRINT 146
ICONF = NCONF(4)
GO TO (1048,1050,1052,1054,1056),ICONF
29 D1
29 D2
29 D3
29 D4
29 D5

CONT. ON PG 29



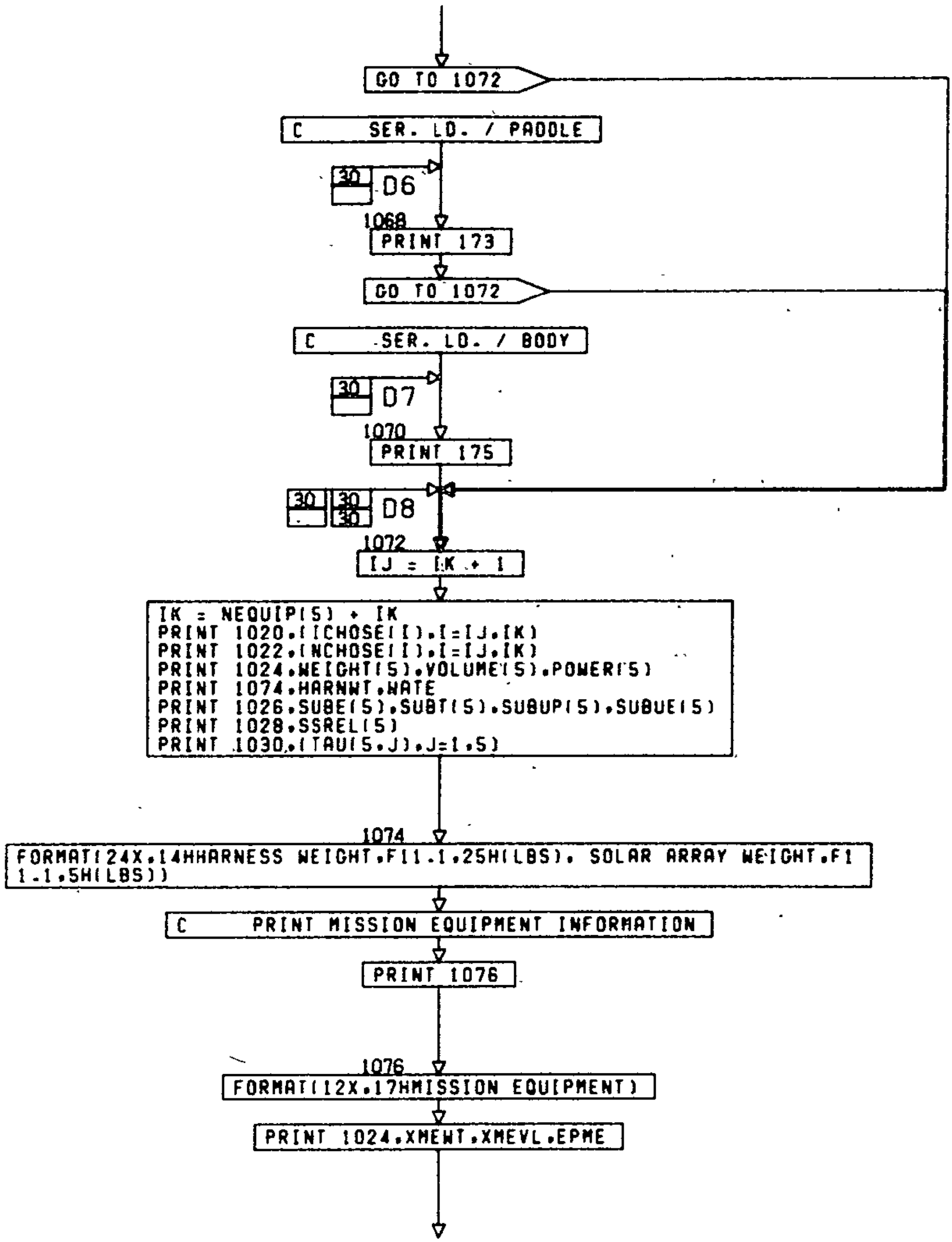
CONT. ON PG 30

PG 29DF 38



PRINT 1020,(ICHOSE(I),I=IJ,IK)
PRINT 1022,(NCHOSE(I),I=IJ,IK)
PRINT 1024,WEIGHT(4),VOLUME(4),POWER(4)
PRINT 1026,SUBE(4),SUBT(4),SUBUP(4),SUBUE(4)
PRINT 1028,SSREL(4)
PRINT 1030,(TAU(4,J),J=1,5)
C PRINT E.P. S/S INFO.
PRINT 162
ICONF = NCONF(5)
GO TO (1060,1062,1064,1066,1068,1070),ICONF
31 06
31 07
C SHNT / PADDLE
1060
PRINT 165
GO TO 1072
31 08
C SHNT / BODY
1062
PRINT 167
GO TO 1072
31 08
C SHNT + DSCHG / PADDLE
1064
PRINT 169
GO TO 1072
31 08
C SHNT + DSCHG / BODY
1066
PRINT 171

CONT. ON PG 31


GO TO 1072
C SER. LD. / PADDLE
30
D6
1068
PRINT 173
GO TO 1072
C SER. LD. / BODY
30
D7
1070
PRINT 175
30
30
30
D8
1072
IJ = IK + 1
IK = NEQUIP(5) + IK
PRINT 1020,(ICHOSE(I),I=IJ,IK)
PRINT 1022,(NCHOSE(I),I=IJ,IK)
PRINT 1024,WEIGHT(5),VOLUME(5),POWER(5)
PRINT 1074,HARNWT,WATE
PRINT 1026,SUBE(5),SUBT(5),SUBUP(5),SUBUE(5)
PRINT 1028,SSREL(5)
PRINT 1030,(TAU(5,J),J=1,5)
1074
FORMAT(24X,14HHARNESS WEIGHT,F11.1,25H(LBS), SOLAR ARRAY WEIGHT,F1
1.1,5H(LBS))
C PRINT MISSION EQUIPMENT INFORMATION
PRINT 1076
1076
FORMAT(12X,17HMISSION EQUIPMENT)
PRINT 1024,XMEWT,XMEVL,EPME

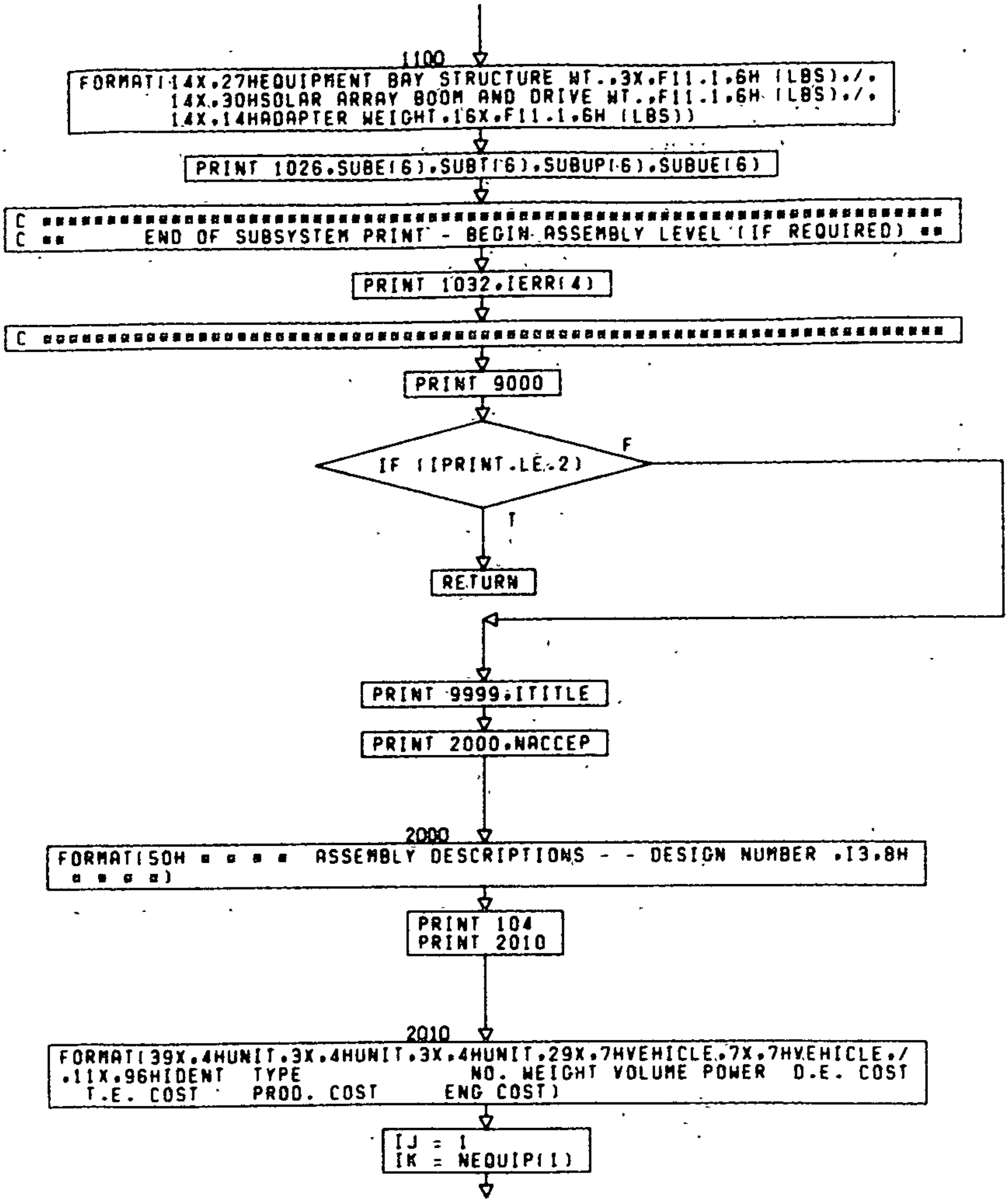
CONT. ON PG 32

```
PRINT 1078,XMER,XMEU

1078
FORMAT(24X,10HDOT+E COST,6X,F11.1,9X,17HAVERAGE UNIT COST,3X,F11.1
)

PRINT 1028,SSREL(6)
PRINT 1030,(TAU(6,J),J=1,5)
PRINT 9000

C     PRINT THERMAL CONTROL SUBSYSTEM INFORMATION

PRINT 1080

1080
FORMAT(12X,15HTHERMAL CONTROL)

PRINT 1082,RADA,RADAB,RAT

1082
FORMAT(14X,13HRADIATOR AREA,3X,F11.1,32H (FT**2),  BATTERY RADIATO
R AREA,7X,F11.1,8H (FT**2),/,52X,19HTOTAL RADIATOR AREA,9X,F11.1,
8H (FT**2))

PRINT 1084,HTRPWR,HTRPRB,HPT

1084
FORMAT(14X,12HHEATER POWER,4X,F11.1,31H(BTU/HR),  BATTERY HEATER P
OWER,8X,F11.1,8H(BTU/HR),/,52X,18HTOTAL HEATER POWER,10X,F11.1,8H(
BTU/HR))

PRINT 1086,HTPIPE,VCHP

1086
FORMAT(14X,10HHEAT PIPE ,6X,F11.1,39H(WATT-IN), VARIABLE CONDUCTAN
CE H.P.    ,F11.1,9H(WATT-IN))

PRINT 1088,THCMWT
```

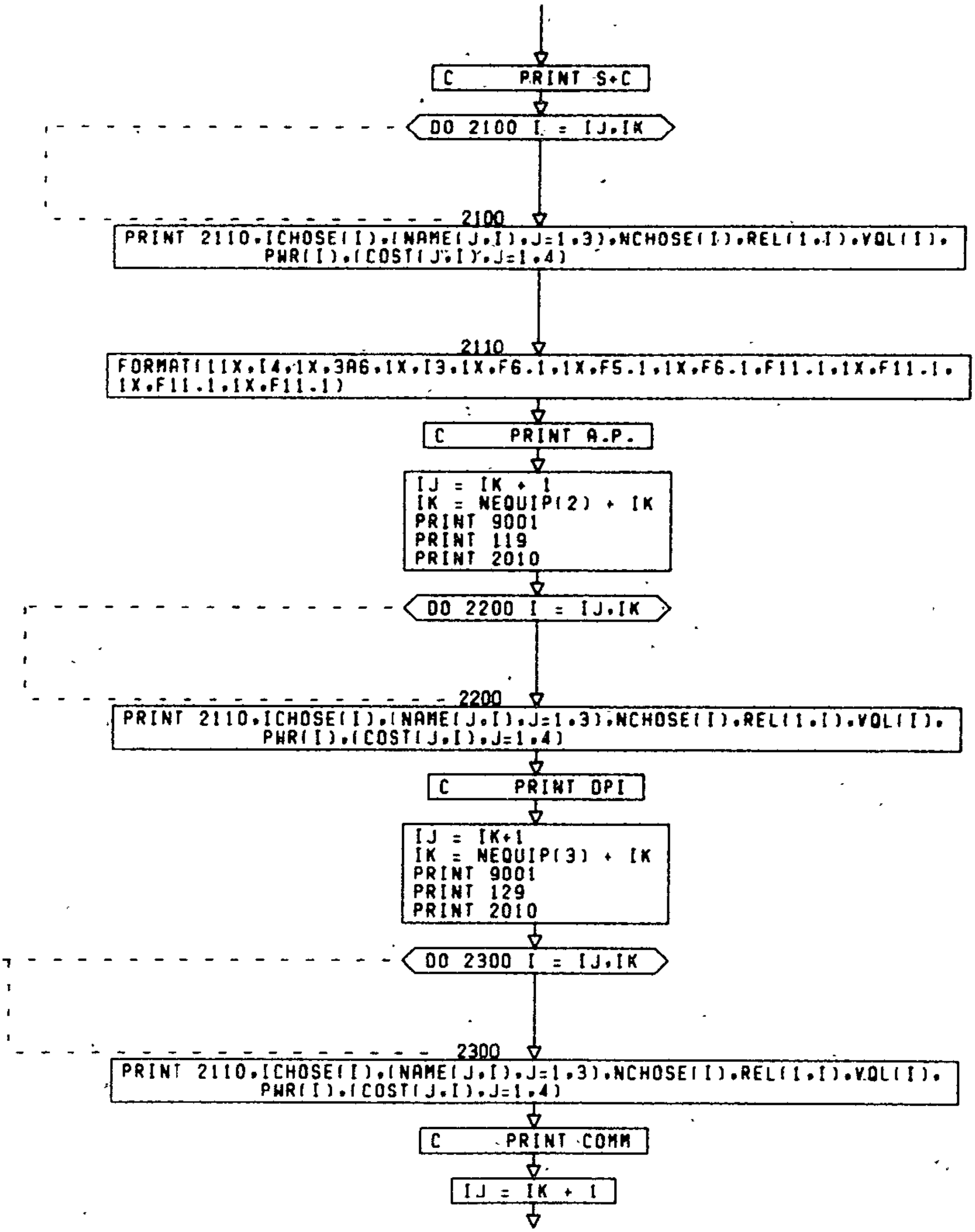
CONT. ON PG 33.

```
1088
FORMAT(14X,23HTHERMAL CONTROL WEIGHT ,F11.1,5H(LBS))

PRINT 1026,SUBE(7),SUBT(7),SUBUP(7),SUBUE(7)
PRINT 1032,IERR(7)

C     PRINT STRUCTURES SUBSYSTEM INFORMATION

PRINT 1090

1090
FORMAT(12X,10HSTRUCTURES)

PRINT 1092,T

1092
FORMAT(14X,16HSKIN THICKNESS  ,F11.3,5H (IN))

PRINT 1094,AN,TS,BS

1094
FORMAT(14X,26HSTRINGER NO.,THICKNESS,HT.,8X,F5.0,5X,1H,,8X,F11.3,6
H (IN),,5X,F11.3,5H (IN))

PRINT 1096,AM,TF,BF

1096
FORMAT(14X,26HFRAME    NO.,THICKNESS,HT.,8X,F5.0,5X,1H,,8X,F11.3,6
H (IN),,5X,F11.3,5H (IN))

PRINT 1098,TC,TB,TA

1098
FORMAT(14X,28HENDCOVER THICKNESS- FORWARD ,F11.3,14H (IN), CENTER
,F11.3,11H (IN), AFT ,F11.3,5H (IN))

PRINT 1100,EQBSTR,SABMWT,SATADP
```

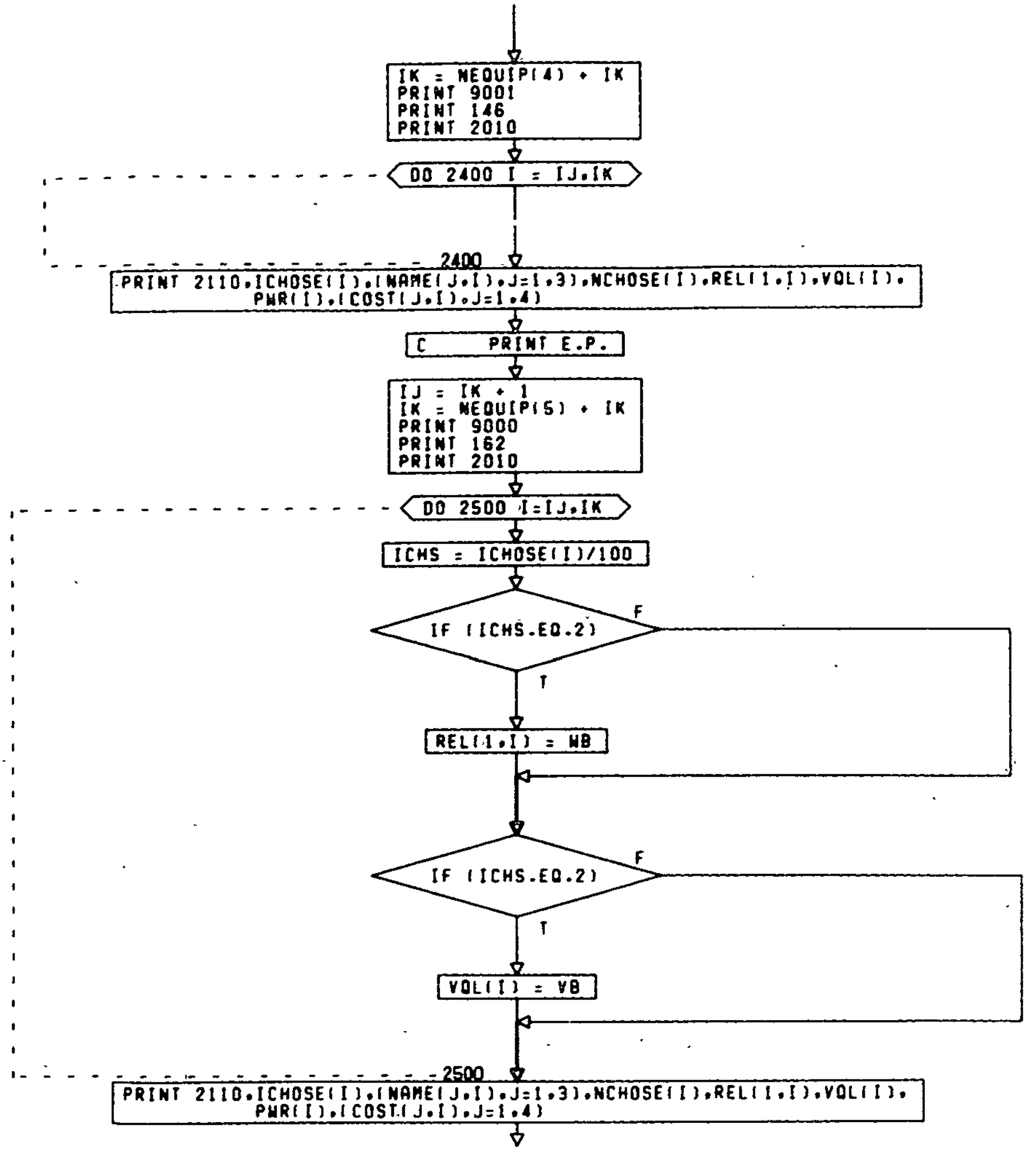
CONT. ON PG 34


1100
FORMAT(14X,27HEQUIPMENT BAY STRUCTURE WT.,3X,F11.1,6H (LBS),/,
14X,30HSOLAR ARRAY BOOM AND DRIVE WT.,F11.1,6H (LBS),/,
14X,14HADAPTER WEIGHT,16X,F11.1,6H (LBS))
PRINT 1026,SUBE(6),SUBT(6),SUBUP(6),SUBUE(6)
C **
C **   END OF SUBSYSTEM PRINT - BEGIN ASSEMBLY LEVEL (IF REQUIRED) **
PRINT 1032,IERR(4)
C **
PRINT 9000
IF (IPRINT.LE.2)
F
T
RETURN
PRINT 9999,ITITLE
PRINT 2000,NACCEP
2000
FORMAT(50H * * * * ASSEMBLY DESCRIPTIONS - - DESIGN NUMBER ,I3,8H
* * * *)
PRINT 104
PRINT 2010
2010
FORMAT(39X,4HUNIT,3X,4HUNIT,3X,4HUNIT,29X,7HVEHICLE,7X,7HVEHICLE,/
,11X,96HIDENT   TYPE   NO. WEIGHT VOLUME POWER D.E. COST
T.E. COST   PROD. COST   ENG COST)
IJ = 1
IK = NEQUIP(1)

CONT. ON PG 35


C PRINT S+C
DO 2100 I = IJ,IK
2100
PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VOL(I), PWR(I),(COST(J,I),J=1,4)
2110
FORMAT(1IX,I4,1X,3A6,1X,I3,1X,F6.1,1X,F5.1,1X,F6.1,F11.1,1X,F11.1, 1X,F11.1,1X,F11.1)
C PRINT A.P.
IJ = IK + 1
IK = NEQUIP(2) + IK
PRINT 9001
PRINT 119
PRINT 2010
DO 2200 I = IJ,IK
2200
PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VOL(I), PWR(I),(COST(J,I),J=1,4)
C PRINT OPI
IJ = IK+1
IK = NEQUIP(3) + IK
PRINT 9001
PRINT 129
PRINT 2010
DO 2300 I = IJ,IK
2300
PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VOL(I), PWR(I),(COST(J,I),J=1,4)
C PRINT COMM
IJ = IK + 1

CONT. ON PG 36


IK = NEQUIP(4) + IK
PRINT 9001
PRINT 146
PRINT 2010
DO 2400 I = IJ,IK
2400
PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(1,I),VOL(I),
PWR(I),(COST(J,I),J=1,4)
C PRINT E.P.
IJ = IK + 1
IK = NEQUIP(5) + IK
PRINT 9000
PRINT 162
PRINT 2010
DO 2500 I=IJ,IK
ICHS = ICHOSE(I)/100
IF (ICHS.EQ.2)
F
T
REL(1,I) = WB
IF (ICHS.EQ.2)
F
T
VOL(I) = VB
2500
PRINT 2110,ICHOSE(I),(NAME(J,I),J=1,3),NCHOSE(I),REL(I,I),VOL(I),
PWR(I),(COST(J,I),J=1,4)

CONT. ON PG 37

```
PRINT 9001
PRINT 2600

2600 FORMAT(10X,46HEQUIPMENTS USING COST ESTIMATING RELATIONSHIPS)

PRINT 2610

2610 FORMAT(88X,7HVEHICLE,7X,7HVEHICLE,/,12X,4HNAME,21X,6HWEIGHT,17X,48
HD.E. COST   T.E. COST    PROD. COST    ENG. COST)

I  = IK + 1
PRINT 2620,WATE,(COST(J,I),J=1,4)

2620 FORMAT(12X,11HSOLAR ARRAY,9X,F11.1,16X,2(F11.1,1X),1X,2(F11.1,2X))

I = I + 1
PRINT 2630,HARNWT,(COST(J,I),J=1,4)

2630 FORMAT(12X,14HHARNESS       ,6X,F11.1,16X,2(F11.1,1X),1X,2(F11.1,2
X))

I = I + 1
PRINT 2640,THCMWT,(COST(J,I),J=1,4)

2640 FORMAT(12X,20HTHERMAL CONTROL     ,F11.1,16X,2(F11.1,1X),1X,2(F11.
1,2X))

I = I + 1
PRINT 2650,CONVWT,(COST(J,I),J=1,4)

2650 FORMAT(12X,16HPOWER CONVERTERS,4X,F11.1,16X,2(F11.1,1X),1X,2(F11.1
,2X))
```

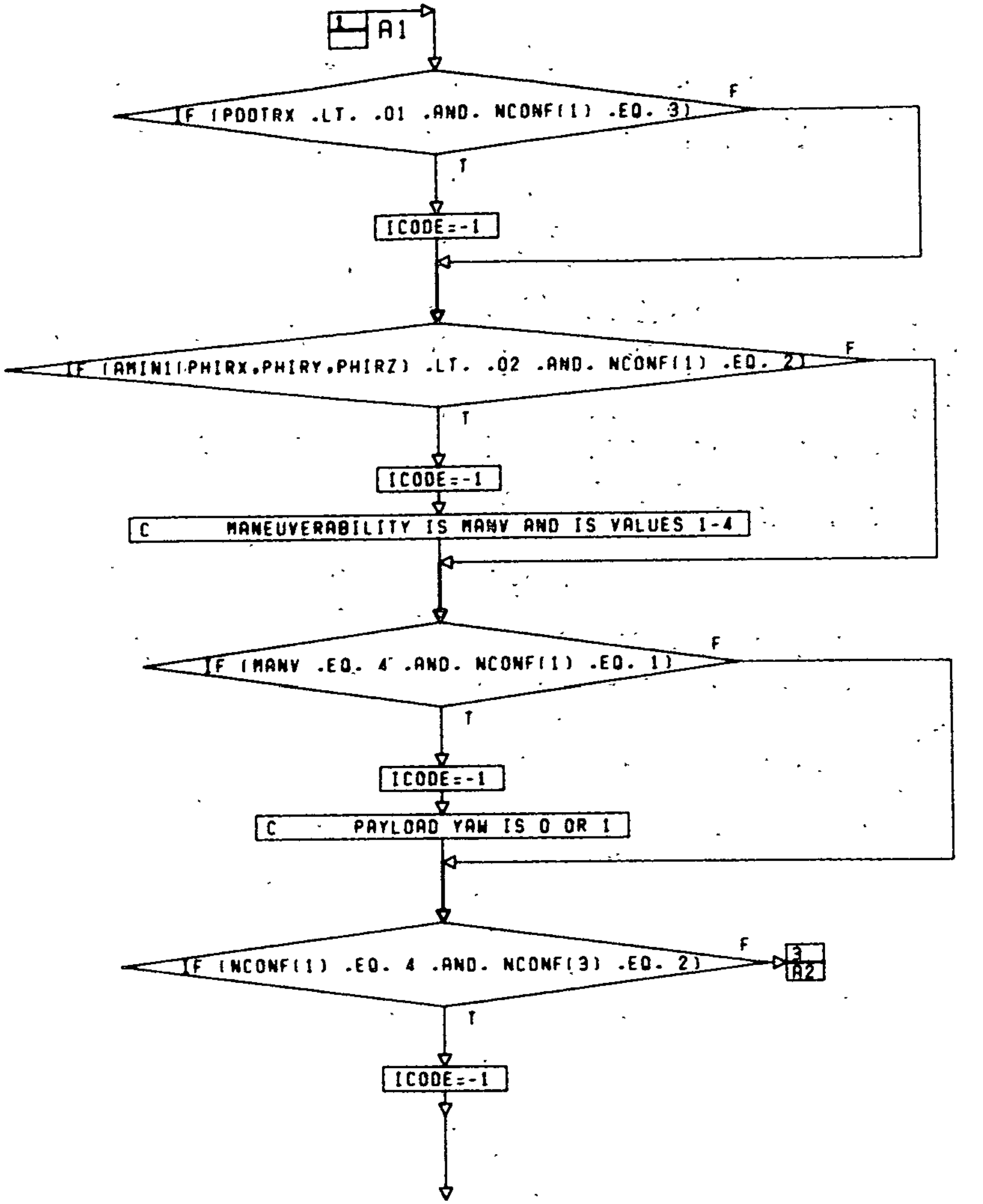
CONT. ON PG 38

```
I = I + 1
PRINT 2660,(COST(J,I),J=1,4)

2660
FORMAT(12X,20HPROPULSION FEED SYS.,     27X,2(F11.1,1X),1X,2(F11.
1,2X))

I = I + 1
PRINT 2670,PASSTR,(COST(J,I),J=1,4)

2670
FORMAT(12X,20HSTRUCTURE              ,F11.1,16X,2(F11.1,1X),1X,2(F11.
1,2X))

I = I + 1
PRINT 2680, POCNWT,(COST(J,I),J=1,4)

2680
FORMAT(12X,20HPOWER CONTROL UNITS ,F11.1,16X,2(F11.1,1X),1X,2(F11.
1,2X))

PRINT 9000

C ******************************************************************
C **       END-OF-PRINT ROUTINE                                   **
C ******************************************************************

RETURN

END
```

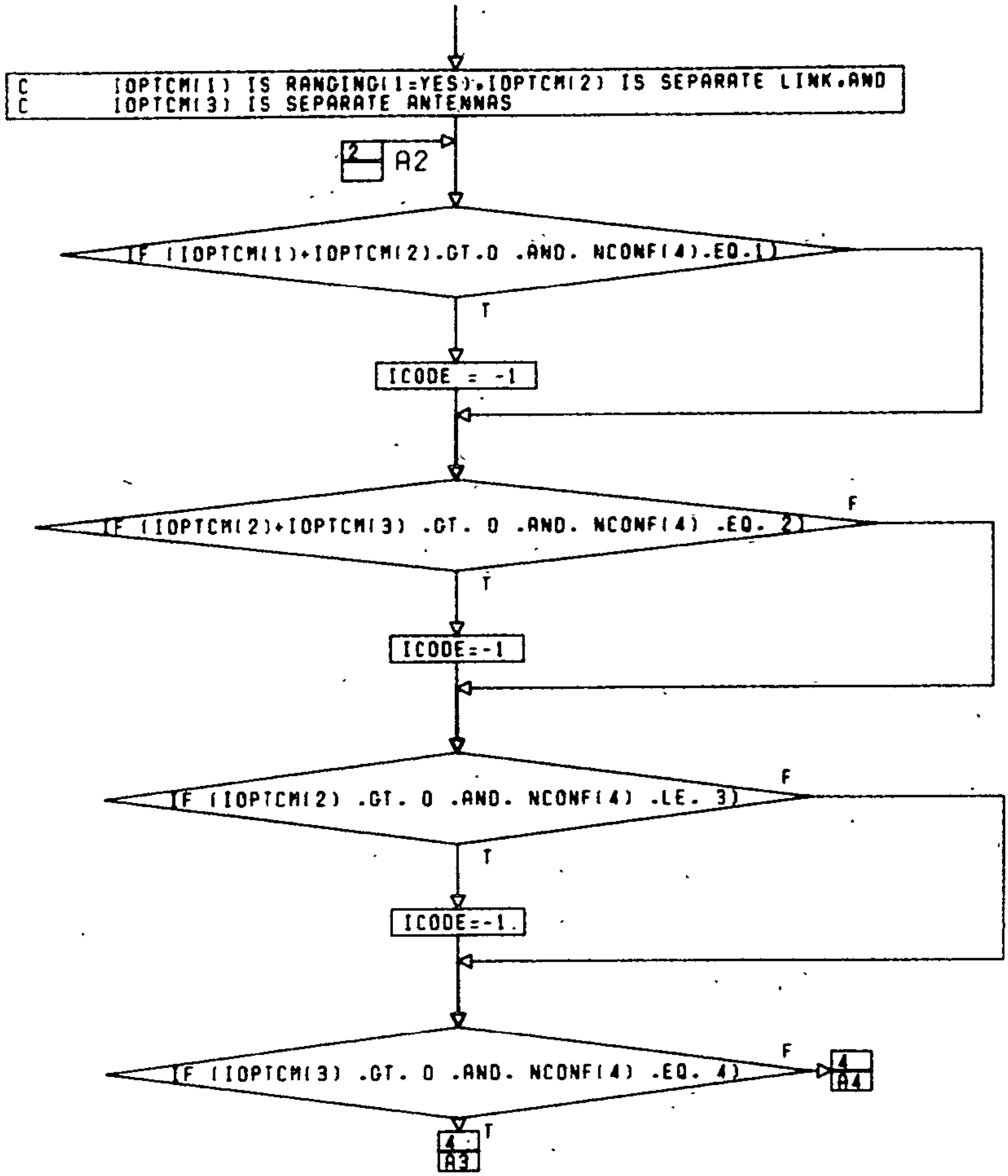
PG 38 FINAL

```
SUBROUTINE FILTER(NCONF,ICODE)

C       FILTER CHECKS FOR COMPATIBLE COMBINATIONS OF CONFIGURATIONS
C       A MINUS 1 IS RETURNED FOR UNACCEPTABLE COMBINATIONS
C       NCONF IS ARRAY OF CONFIGURATIONS
C       ICODE IS CODE RETURNED

DIMENSION NCONF(6)

COMMON /USER1/    ALPHA,     AX,      AY,      AZ,     DPHI,
                     EA,   EANT,     EPI,       K,     MANV,
                  OMEGR, PDOTAV,  PDOTRX,  PDOTRY,   PDOTRZ,
                 PDOTST,  PDOTX,   PDOTY,   PDOTZ,    PDOTO,
                 PHIFOV,  PHIRX,   PHIRY,   PHIRZ,   TACCEL,
                 THETMX,  THOLD,      TL,   TPMIN,   TSMALL,
                     XN,    XNN,    XNNN,     XNU,       YN,
                     ZN

COMMON /USER3/ARRAYN(11,3), BTRMX,   NMSEQ,   OPSMS,   SCSFL,
                 TPRFL

COMMON /USER4/BWIDTH(2),  FREQ(2),   FREQR,IOPTCM(3),   LINK,
                 NADIR,      NET

COMMON /USERI/   APOGEE,  COMRAT,  DIAMAX, EEQWT(9),   EPME,
                 EQM1NT,  EQM1XL,  EQM1YL,  EQM1ZL,  EQM2WT,
                 EQM2XL,  EQM2YL,  EQM2ZL,      FE,  IAGNCY,
         IDEBUG, ISATOR,  MB12SH,  OPTEMP,  ORBINC,  PERIGE,
          MICRO,  RELME, SPEC(6),   SPEC1,       T,  XCGSA1,
                   XMER,    XMEU

ICODE=0

C       CHECK S AND C

IF (PDOTRX .LT. .01 .AND. NCONF(1) .EQ. 1)    F -> 2 A1
T

ICODE = -1
```

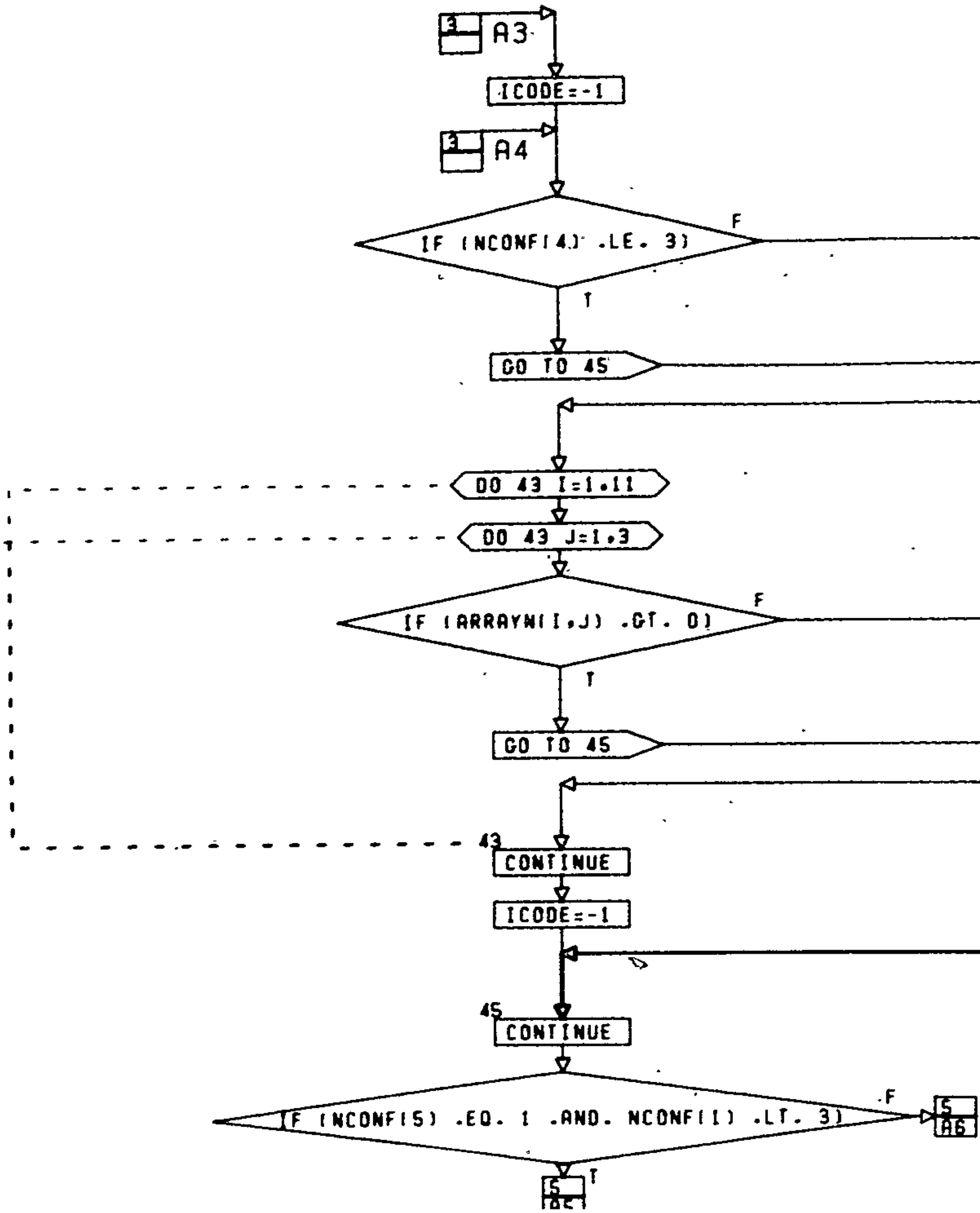
CONT. ON PG 2


A1
IF (PDOTRX .LT. .01 .AND. NCONF(1) .EQ. 3)
F
T
ICODE=-1
IF (AMIN1(PHIRX,PHIRY,PHIRZ) .LT. .02 .AND. NCONF(1) .EQ. 2)
F
T
ICODE=-1
C MANEUVERABILITY IS MANV AND IS VALUES 1-4
IF (MANV .EQ. 4 .AND. NCONF(1) .EQ. 1)
F
T
ICODE=-1
C PAYLOAD YAW IS 0 OR 1
IF (NCONF(1) .EQ. 4 .AND. NCONF(3) .EQ. 2)
F
3
A2
T
ICODE=-1

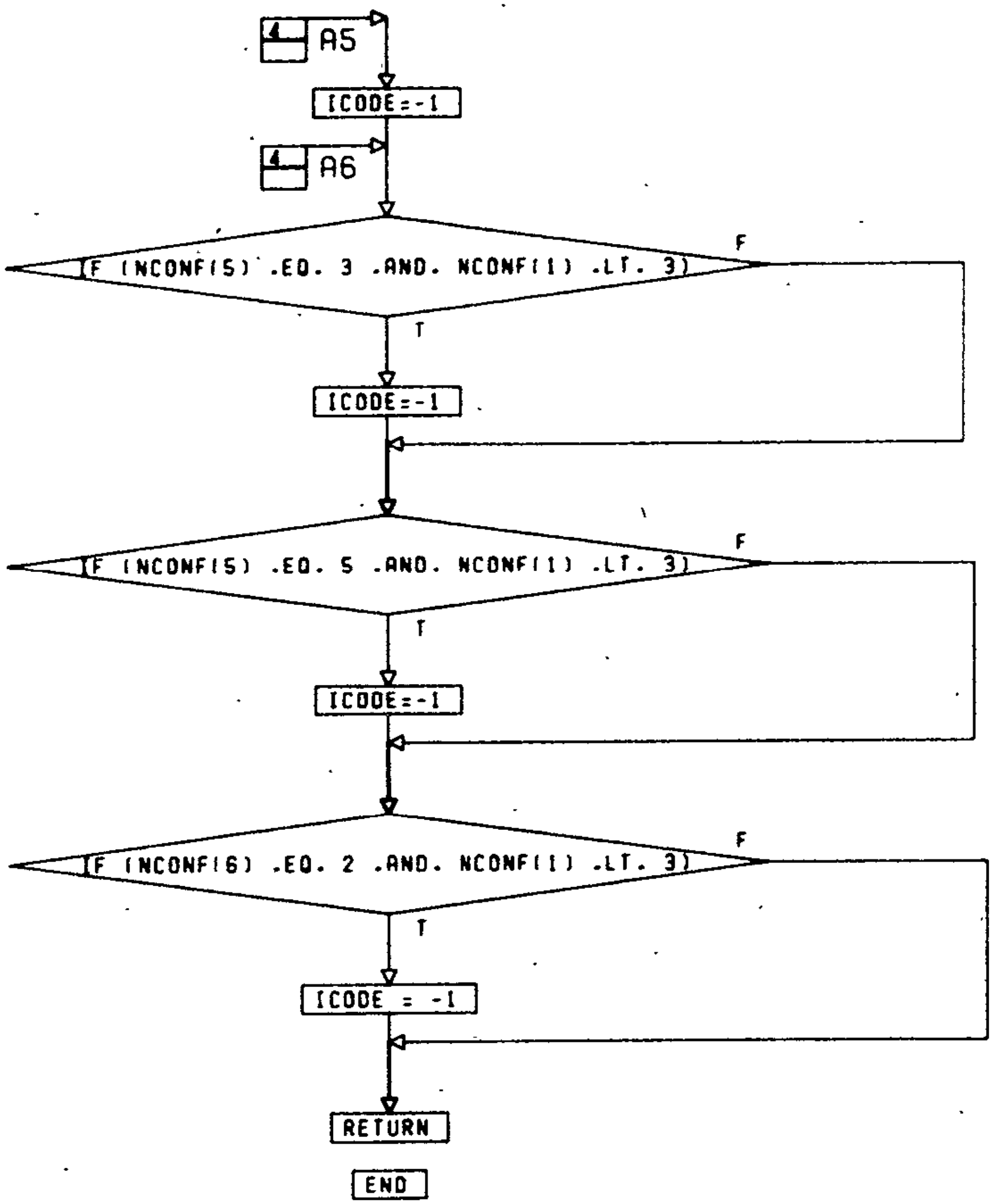
CONT. ON PG 3


C IOPTCM(1) IS RANGING(1=YES),IOPTCM(2) IS SEPARATE LINK,AND
C IOPTCM(3) IS SEPARATE ANTENNAS
2
A2
IF (IOPTCM(1)+IOPTCM(2).GT.0 .AND. NCONF(4).EQ.1)
T
ICODE = -1
IF (IOPTCM(2)+IOPTCM(3) .GT. 0 .AND. NCONF(4) .EQ. 2)
F
T
ICODE=-1
IF (IOPTCM(2) .GT. 0 .AND. NCONF(4) .LE. 3)
F
T
ICODE=-1.
IF (IOPTCM(3) .GT. 0 .AND. NCONF(4) .EQ. 4)
F
4
A4
T
4
A3

CONT. ON PG 4

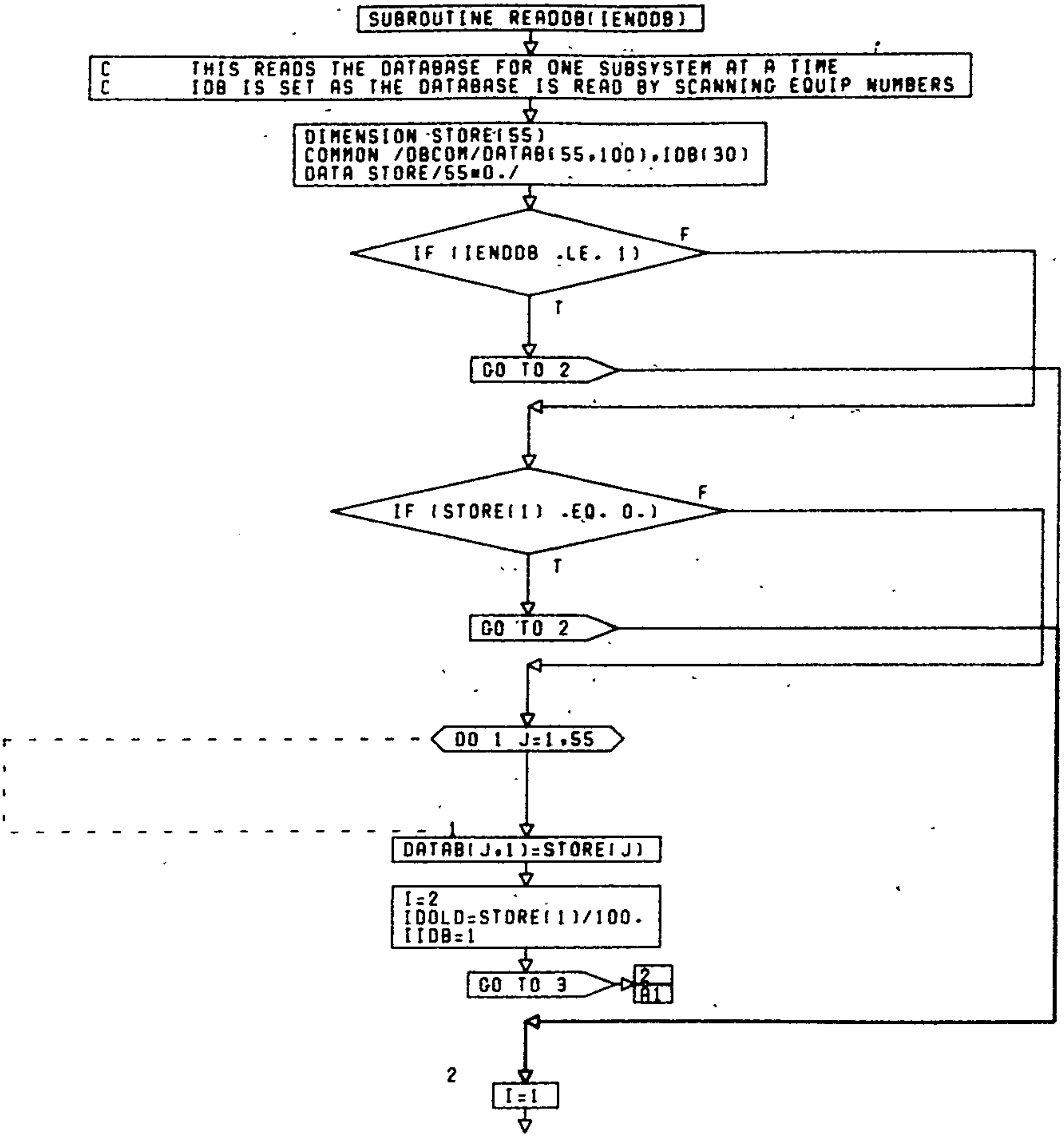

A3
ICODE=-1
A4
IF (NCONF(4) .LE. 3)
F
T
GO TO 45
DO 43 I=1,11
DO 43 J=1,3
IF (ARRAYN(I,J) .GT. 0)
GO TO 45
43
CONTINUE
ICODE=-1
45
CONTINUE
IF (NCONF(5) .EQ. 1 .AND. NCONF(1) .LT. 3)
A6

CONT. ON PG 5

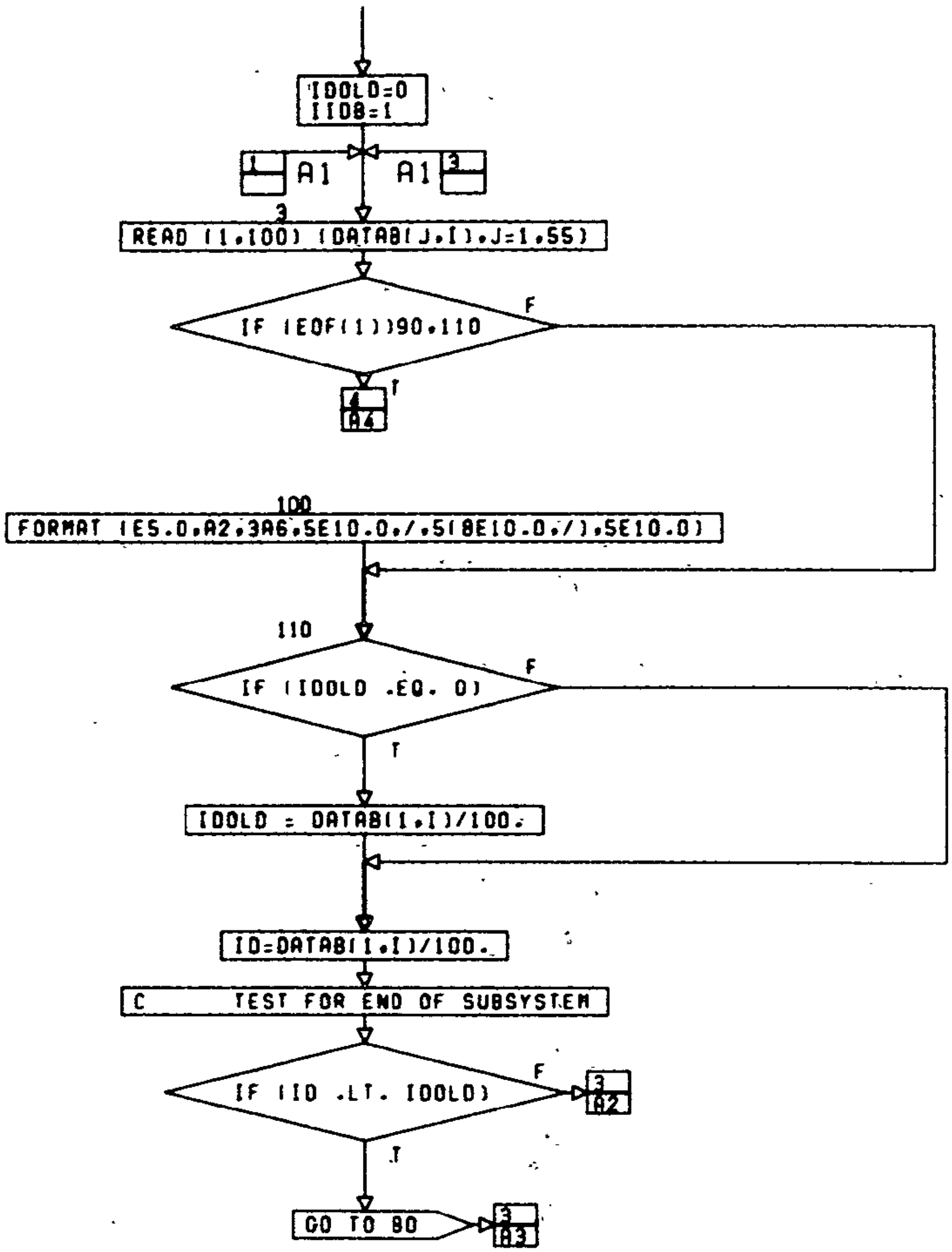


A5
ICODE=-1
A6
IF (NCONF(5) .EQ. 3 .AND. NCONF(1) .LT. 3)
F
T
ICODE=-1
IF (NCONF(5) .EQ. 5 .AND. NCONF(1) .LT. 3)
F
T
ICODE=-1
IF (NCONF(6) .EQ. 2 .AND. NCONF(1) .LT. 3)
F
T
ICODE = -1
RETURN
END

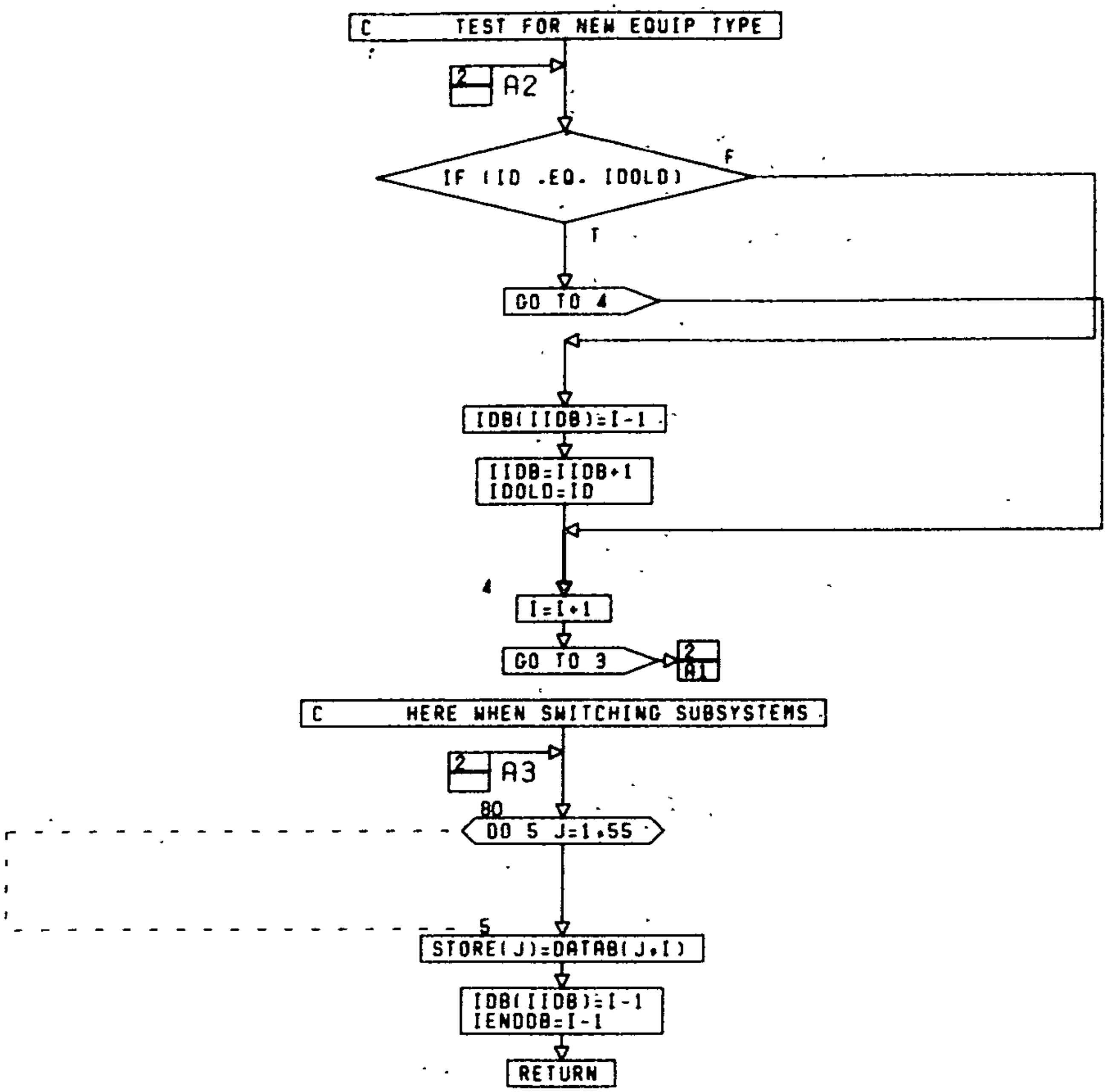
PG 5 FINAL


SUBROUTINE READDB(IENDDB)
C THIS READS THE DATABASE FOR ONE SUBSYSTEM AT A TIME
C IDB IS SET AS THE DATABASE IS READ BY SCANNING EQUIP NUMBERS
DIMENSION STORE(55)
COMMON /DBCOM/DATAB(55,100),IDB(30)
DATA STORE/55*0./
IF (IENDDB .LE. 1)
F
T
GO TO 2
IF (STORE(1) .EQ. 0.)
F
T
GO TO 2
DO 1 J=1,55
1
DATAB(J,1)=STORE(J)
I=2
IDOLD=STORE(1)/100.
IIDB=1
GO TO 3
2
A1
2
I=1

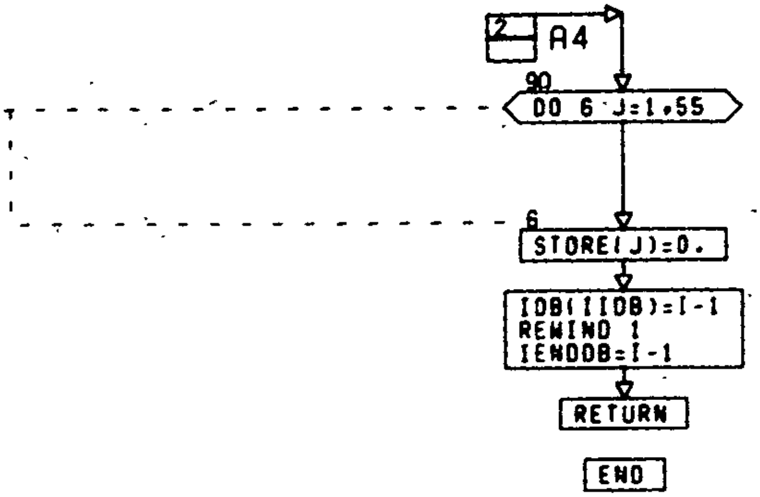
CONT. ON PG 2


IDOLD=0
IID8=1
1 A1
A1 3
3
READ (1,100) (DATAB(J,I),J=1,55)
IF (EOF(1))90,110
F
T
4
A4
100
FORMAT (E5.0,A2,3A6,5E10.0,/,5(8E10.0,/),5E10.0)
110
IF (IDOLD .EQ. 0)
F
T
IDOLD = DATAB(1,I)/100.
ID=DATAB(1,I)/100.
C TEST FOR END OF SUBSYSTEM
IF (ID .LT. IDOLD)
F
3
A2
T
GO TO 80
3
A3

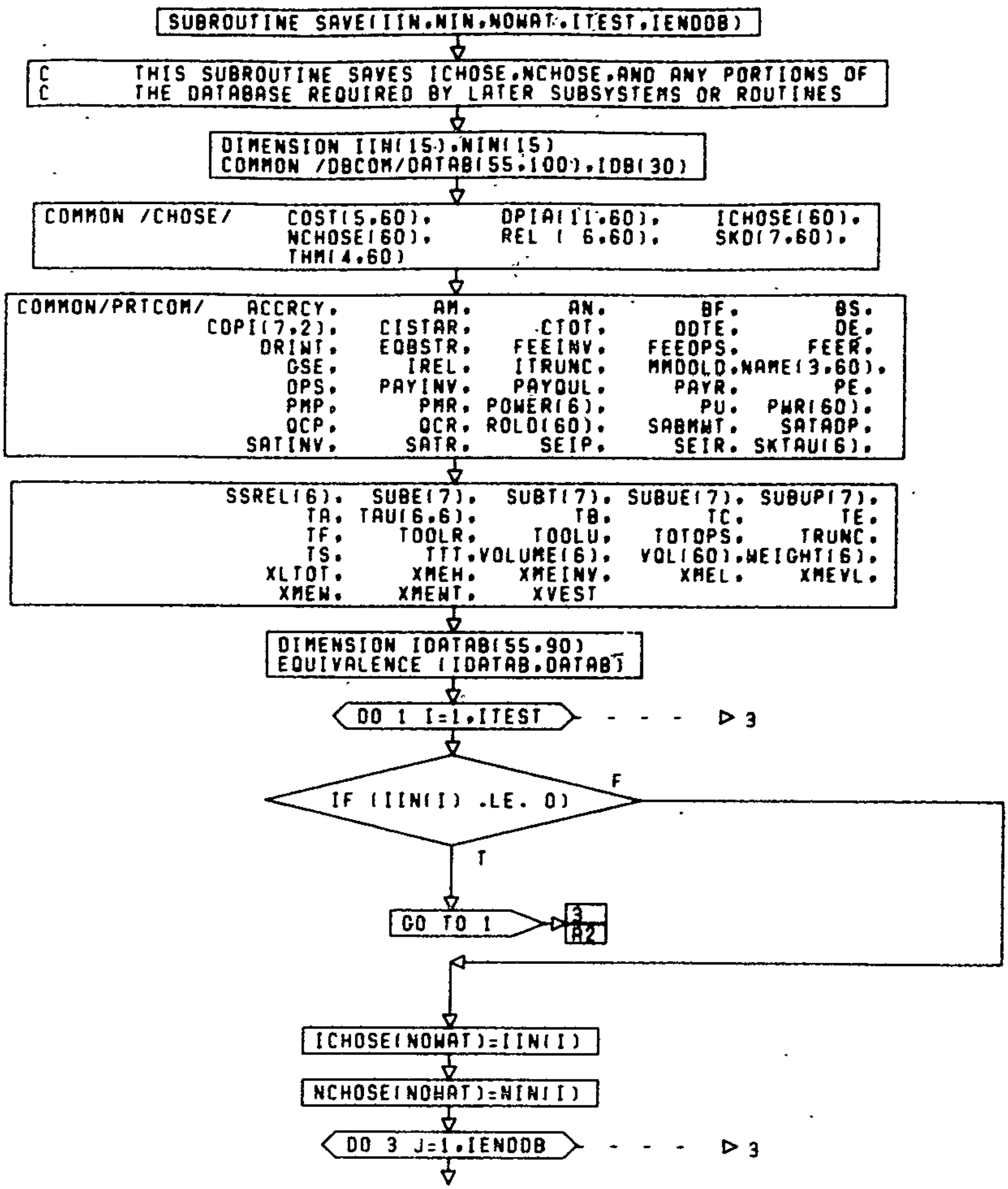
CONT. ON PG 3


C TEST FOR NEW EQUIP TYPE
2
A2
IF (ID .EQ. IDOLD)
F
T
GO TO 4
IDB(IIDB)=I-1
IIDB=IIDB+1
IDOLD=ID
4
I=I+1
GO TO 3
2
A1
C HERE WHEN SWITCHING SUBSYSTEMS
2
A3
80
DO 5 J=1,55
5
STORE(J)=DATAB(J,I)
IDB(IIDB)=I-1
IENDDB=I-1
RETURN

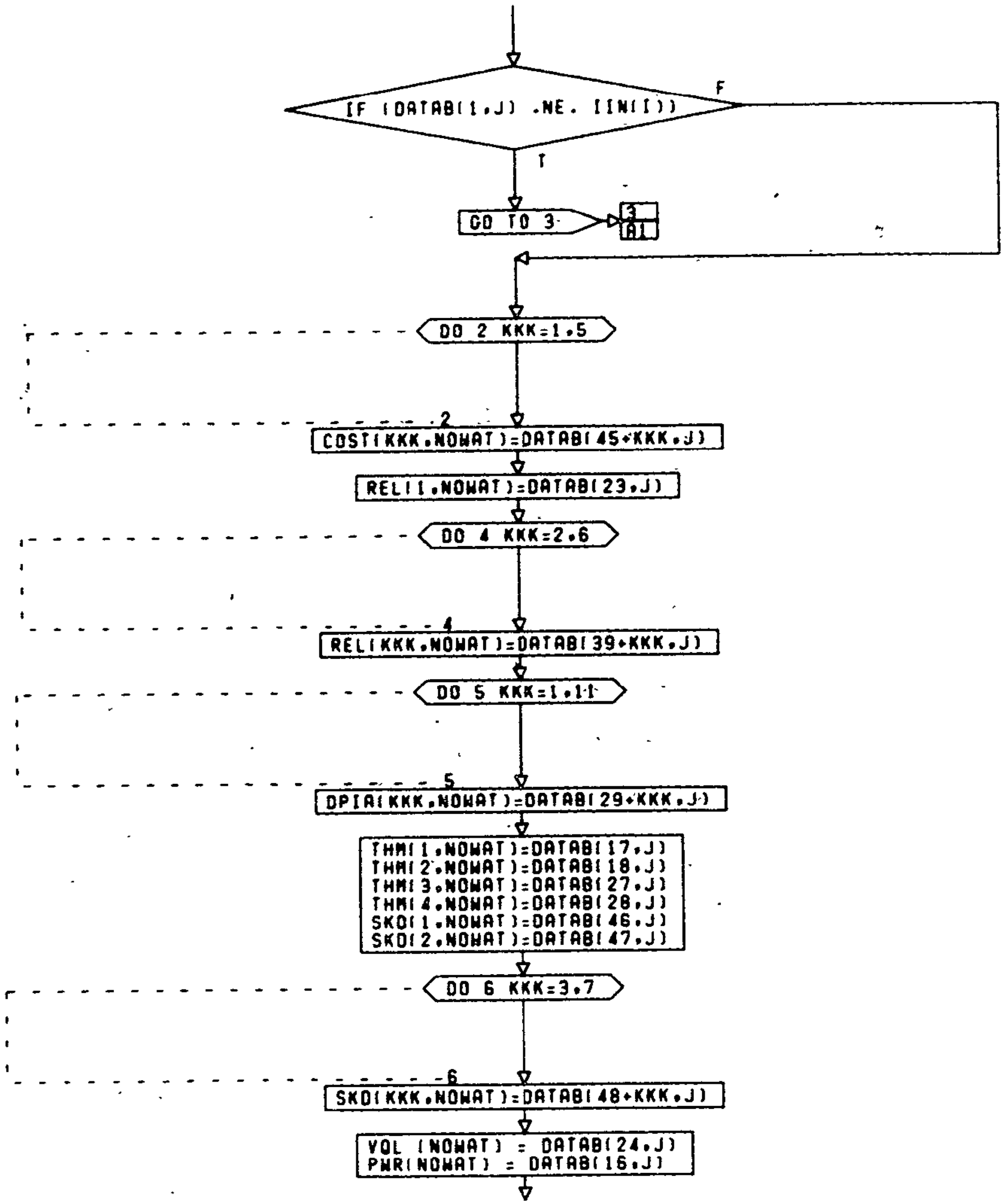
CONT. ON PG 4


2
A4
90
DO 6 J=1,55
6
STORE(J)=0.
IDB(IIDB)=I-1
REWIND 1
IENDDB=I-1
RETURN
END

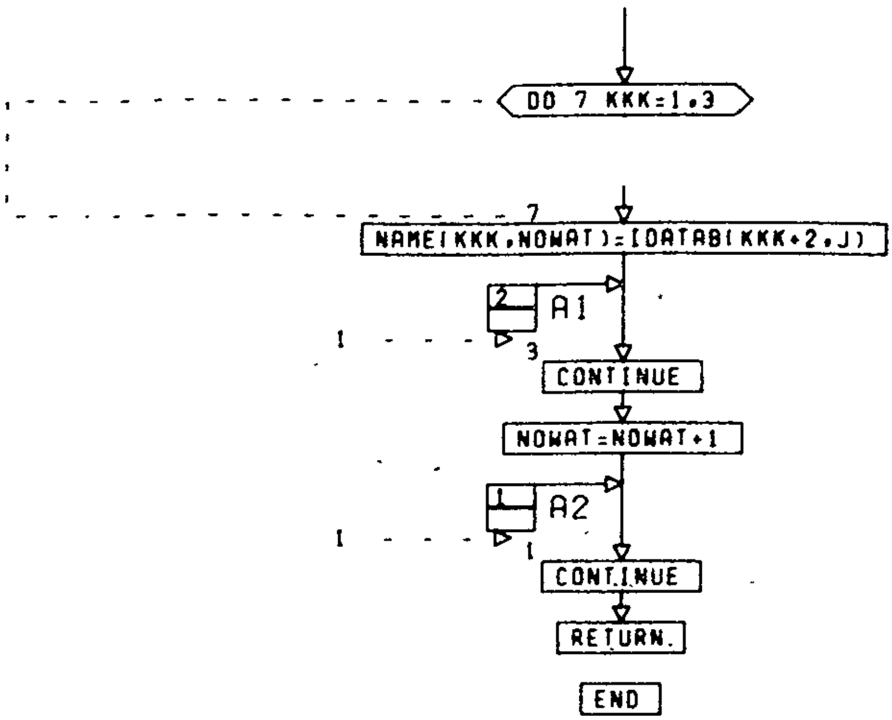
PG 4 FINAL


SUBROUTINE SAVE(IIN,NIN,NOWAT,ITEST,IENDDB)
C THIS SUBROUTINE SAVES ICHOSE,NCHOSE,AND ANY PORTIONS OF
C THE DATABASE REQUIRED BY LATER SUBSYSTEMS OR ROUTINES
DIMENSION IIN(15),NIN(15)
COMMON /DBCOM/DATAB(55,100),IDB(30)
COMMON /CHOSE/ COST(5,60), DPIA(11,60), ICHOSE(60), NCHOSE(60), REL (6,60), SKD(7,60), THM(4,60)
COMMON/PRTCOM/ ACCRCY, AM, AN, BF, BS, COPI(7,2), CISTAR, CTOT, DDTE, DE, DRINT, EQBSTR, FEEINV, FEEOPS, FEER, GSE, IREL, ITRUNC, MMDOLD,NAME(3,60), OPS, PAYINV, PAYOUL, PAYR, PE, PMP, PMR, POWER(6), PU, PWR(60), QCP, QCR, ROLD(60), SABMWT, SATADP, SATINV, SATR, SEIP, SEIR, SKTAU(6),
SSREL(6), SUBE(7), SUBT(7), SUBUE(7), SUBUP(7), TA, TAU(6,6), TB, TC, TE, TF, TOOLR, TOOLU, TOTOPS, TRUNC, TS, TTT,VOLUME(6), VOL(60),WEIGHT(6), XLTOT, XMEH, XMEINV, XMEL, XMEVL, XMEW, XMEWT, XVEST
DIMENSION IDATAB(55,90)
EQUIVALENCE (IDATAB,DATAB)
DO 1 I=1,ITEST
3
IF (IIN(I) .LE. 0)
F
T
GO TO 1
3
A2
ICHOSE(NOWAT)=IIN(I)
NCHOSE(NOWAT)=NIN(I)
DO 3 J=1,IENDDB
3

CONT. ON PG 2


IF (DATAB(1,J) .NE. IIN(I))
F
T
GO TO 3
3
A1
DO 2 KKK=1,5
2
COST(KKK,NOWAT)=DATAB(45+KKK,J)
REL(1,NOWAT)=DATAB(23,J)
DO 4 KKK=2,6
4
REL(KKK,NOWAT)=DATAB(39+KKK,J)
DO 5 KKK=1,11
5
DPIA(KKK,NOWAT)=DATAB(29+KKK,J)
THM(1,NOWAT)=DATAB(17,J)
THM(2,NOWAT)=DATAB(18,J)
THM(3,NOWAT)=DATAB(27,J)
THM(4,NOWAT)=DATAB(28,J)
SKD(1,NOWAT)=DATAB(46,J)
SKD(2,NOWAT)=DATAB(47,J)
DO 6 KKK=3,7
6
SKD(KKK,NOWAT)=DATAB(48+KKK,J)
VOL (NOWAT) = DATAB(24,J)
PWR(NOWAT) = DATAB(16,J)

CONT. ON PG 3


DO 7 KKK=1,3
7
NAME(KKK,NOWAT)=IDATAB(KKK+2,J)
2
A1
1
3
CONTINUE
NOWAT=NOWAT+1
1
A2
1
1
CONTINUE
RETURN.
END

PG 3 FINAL

```
SUBROUTINE THRML (IERR,NCONF)

COMMON /USERI/     APOGEE,   COMRAT,   DIAMAX, EEQWT(9),     EPME,
                   EQM1WT,   EQM1XL,   EQM1YL,   EQM1ZL,   EQM2WT,
                   EQM2XL,   EQM2YL,   EQM2ZL,       FE,   IAGNCY,
          IDEBUG,  ISATOR,   MB12SH,   OPTEMP,   ORBINC,   PERIGE,
           MICRO,   RELME,  SPEC(6),    SPEC1,        T,   XCGSAI,
                    XMER,     XMEU

COMMON /BTWN/       ACSSN,    ACSWP,      ALT,     AREA,   BATCAP,
               BITRAT(2),    CLIFE,   CONVWT,        D,       DT,
                      DX,       DY,       DZ,    EQBLG,   EQBSID,
                      FC,       FF,   HARNWT,      HPT,   HTPIPE,
                    HTPT,   HTRPRB,   HTRPWR,            IBTLOC,
                   LMBOD,       NC,    OMEGS,   PASSTR,       PJ,
                      PL,    PLMIN,   POCNWT,     RADA,    RADAB,
                     RAT,       RJ,   SABOLG,    SATLG,   SATTWT,

                   SATWT,   SATXCG,   SATYCG,   SATZCG,    SA1XL,
                   SA1YL,    SA1ZL,     SIDE,    SYSLB,   THCMWT,
               THRUST(2),       TI,    TNKWT,    TPRIM,       VB,
                    VCHP,      VOL,     WATE,       WB,      WBT,
                      WT,       XJ,   XNZERO,       YJ,       ZJ

COMMON /CHOSE/     COST(5,60),      DPIA(11,60),     ICHOSE(60),
                   NCHOSE(60),      REL ( 6,60),     SKD(7,60),
                 THRMDB(4,60)

DIMENSION NCONF(6)
REAL LNGTH

DATA SIGMA/0.1714E-08/,QS/442.0/,EMISS/60.0/,ALBDO/155.0/,CONST/1..
5/,PIE/3.1415926535/

C ******************************************************************
C ******************************************************************
C **  SUBROUTINE THRML USES A METHODOLOGY FOR SIZING THE THERMAL   **
C **  CONTROL SUB-SYSTEM FOR A VARIETY OF SPACECRAFT. THIS METHODOLOGY**
C **  DETERMINES SIZE AND PERFORMANCE OF THE THERMAL SUB-SYSTEM    **
C ******************************************************************
C ******************************************************************
C **  A GLOSSARY OF VARIABLES FOLLOWS - -                          **

C ******************************************************************
C **                                                               **
C **      CODE IS AS FOLLOWS - -                                   **
C **           U = USER INPUT, DB = DATA BASE, INT = INTERNAL      **
C **           O = OUTPUT, I = INPUT FROM MAIN OR OTHER S/S        **
C ******************************************************************
C **      VAR. NAME      CODE      UNITS (DEFAULT)     DESCRIPTION **
C **                                                               **

C ******************************************************************
C **                                                               **
```

CONT. ON PG

```
C **     ALBDO      INT       1.55 BTU/(HR*FT**2)          ALBEDO             **
C **                                                                          **
C **     ALPHA      INT       0.30 (DIMENSIONLESS)         CONV.RAD.CONST.    **
C **                          0.08 (DIMENSIONLESS)         OSR. RAD.CONST.    **
C **                                                                          **
C **                                                                          **
C **     ALT        U                           N.MI.      ALTITUDE           **
```

```
C **                                                                          **
C **     BV         INT       1.1               VOC        MAX BATT.VOLT.     **
C **                                                                          **
C **     CA         INT       0.5               AMPS       BATT TRICKLE       **
C **                                                                          **
C **     CONST      INT       1.5                          K CONSTANT         **
C **                                                                          **
C **     EMISS      INT       60  BTU/(HR*FT**2)           EARTH EMISSION     **
```

```
C **                                                                          **
C **     EPSLON     INT       0.75 (DIMENSIONLESS)         CONV.RAD.CONST.    **
C **                          0.73 (DIMENSIONLESS)         OSR. RAD.CONST.    **
C **                                                                          **
C **     ETAT       INT                               XMTR EFFICIENCY         **
C **                                                                          **
C **     HPT        0                          (BTU/HR) TOTAL HEATER POWER    **
C **                                                                          **
```

```
C **     HTPIPE     0                          (BTU/HR) HEAT DUE TO H.P.      **
C **                                                                          **
C **     HTPT       0                          (BTU/HR)TOTAL HEAT PIPE        **
C **                                                                          **
C **     HTRPRB     0                          (BTU/HR)BATT. HEATER POWER     **
C **                                                                          **
C **     HTRPHR     0                          (BTU/HR)OTHER HEATER POWER     **
C **                                                                          **
```

```
C **     I          INT                               INDEX                   **
C **                                                                          **
C **     IBTLOC     I                                 BATTERY LOCATION        **
C **                                                                          **
C **     ICONF      INT                               TYPE OF CONFIG.         **
C **     ISATOR     U          1     (DIMENSIONLESS)     EARTH ORIENTED       **
C **                           2     (DIMENSIONLESS)     SUN   ORIENTED       **
C **                           3     (DIMENSIONLESS)     INERTIALLY ORI.      **
```

```
C **                                                                          **
C **     NC                                                NUMBER BATT CEL    **
C **                                                                          **
C **     NCONF(1)   I                                      S+C MACRO INDEX    **
C **     NCONF(6)   I                                      VS  MACRO INDEX    **
C **                                                                          **
C **     ORBINC     U                          DEGREES     ORBIT INCLINAT.    **
C **                                                                          **
```

```
C **     PCM        0                             KG PHASE CHANGE MASS        **
C **                                                                          **
C **     PIE        INT                    3.14159265 CONSTANT                **
C **                                                                          **
```

CONT. ON PG 3

```
C **                                                                        **
C **      PMAX       INT (DB)                      WATTS.    PWR MAX        **
C **                                                                        **
C **      PMIN       INT (DB)                      WATTS     PWR MIN        **
```

```
C **                                                                        **
C **      QMAX       INT                    (BTU/HR)       MAX PWR DISSAP.**
C **                                                                        **
C **      QMAXB      INT                    (BTU/HR) BATT.POWER MAXIMUM     **
C **                                                                        **
C **      QMIN       INT                    (BTU/HR)       MIN PWR DISSAP.**
C **                                                                        **
C **      QMINB      INT                    (BTU/HR) BATT.POWER MINIMUM     **
```

```
C **                                                                        **
C **      QS         INT     442.0 BTU/(HR*FT**2)       SOLAR CONST.        **
C **                                                                        **
C **      RADA       0                      (FT**2)     RADIATOR AREA       **
C **                                                                        **
C **      RADAB      0                       FT**2 BATT.RAD.AREA            **
C **                                                                        **
C **      RAT        0                       FT**2 TOTAL RAD. AREA          **
```

```
C **                                                                        **
C **      SATLG      I   (VS)               INCHES      SAT. LENGTH         **
C **                                                                        **
C **      SATRAD     I   (VS)               INCHES      SAT. RADIUS         **
C **                                                                        **
C **      SIGMA      INT     0.1714E-8BTU/(HR*FT2*R4) BOLTZMANN CONST**
C **                                                                        **
C **      THRMDB     I                            THERMAL DATA BASE
```

```
C **                                                                        **
C **      TMAX       INT (DB)               DEGREES R  MAX TEMPERATURE**
C **                                                                        **
C **      TMAXB      INT                          BATT. MAX. TEMP.          **
C **                                                                        **
C **      TMIN       INT (DB)               DEGREES R  MIN TEMPERATURE**
C **                                                                        **
C **      TMINB      INT                          BATT. MIN. TEMP.          **
```

```
C **                                                                        **
C **      VCHP       0                            VAR.COND.HEAT PIPE        **
C **                                                                        **
C **                                                                        **
C **                                                                        **
C ************************************************************************
C ************************************************************************
C ************************************************************************
```

```
C *                         2                                               *
C *                                                                         *
C *                   O          D                                          *
C *                   S     I    I                                          *
```

CONT. ON PG 4

```
C *                            R     S  O        C     R                  *
C *                            +     O  D     O  O  H  A                  *
C *      :                     V     T  E     S  N  E  D                  *
C *                            C     H        R  V  A  I                  *
```

```
C *                            H     E  H  H           T  A               *
C *                            E  P  R  E  E  R  R  E  T                  *
C *                            A  C  M  A  A  A  A  R  O                  *
C *                            T  M  A  T  T  D  D     R                  *
C *                         R        L        I  I  P                     *
C *                         A  P  M  I  P  P  A  A  O  A                  *
C *                         D  I  A  Z  I  I  T  T  W  R                  *
C *                         A  P  S  E  P  P  O  O  E  E                  *
```

```
C *                         B  E  S  R  E  E  R  R  R  A                  *
C *                                                                       *
C *        IERR   =         X  X  X  X  X  X  X  X  X  X                  *
C *                                                                       *
C *             WHERE  0  MEANS NO SUCH REQUIREMENT, OR                   *
C *                    1  MEANS WE HAVE THIS REQUIREMENT                  *
C *                                                                       *
C ************************************************************************
```

```
C ************************************************************************
C ************************************************************************
C *                                                                      *
C **       INITIALIZATION FOLLOWS - -
```

```
RADA=0.
RADAB=0.
RAT=0.0
HTRPWR=0.
HTRPRB=0.
HPT=0.
HTPIPE=0.
VCHP=0.
```

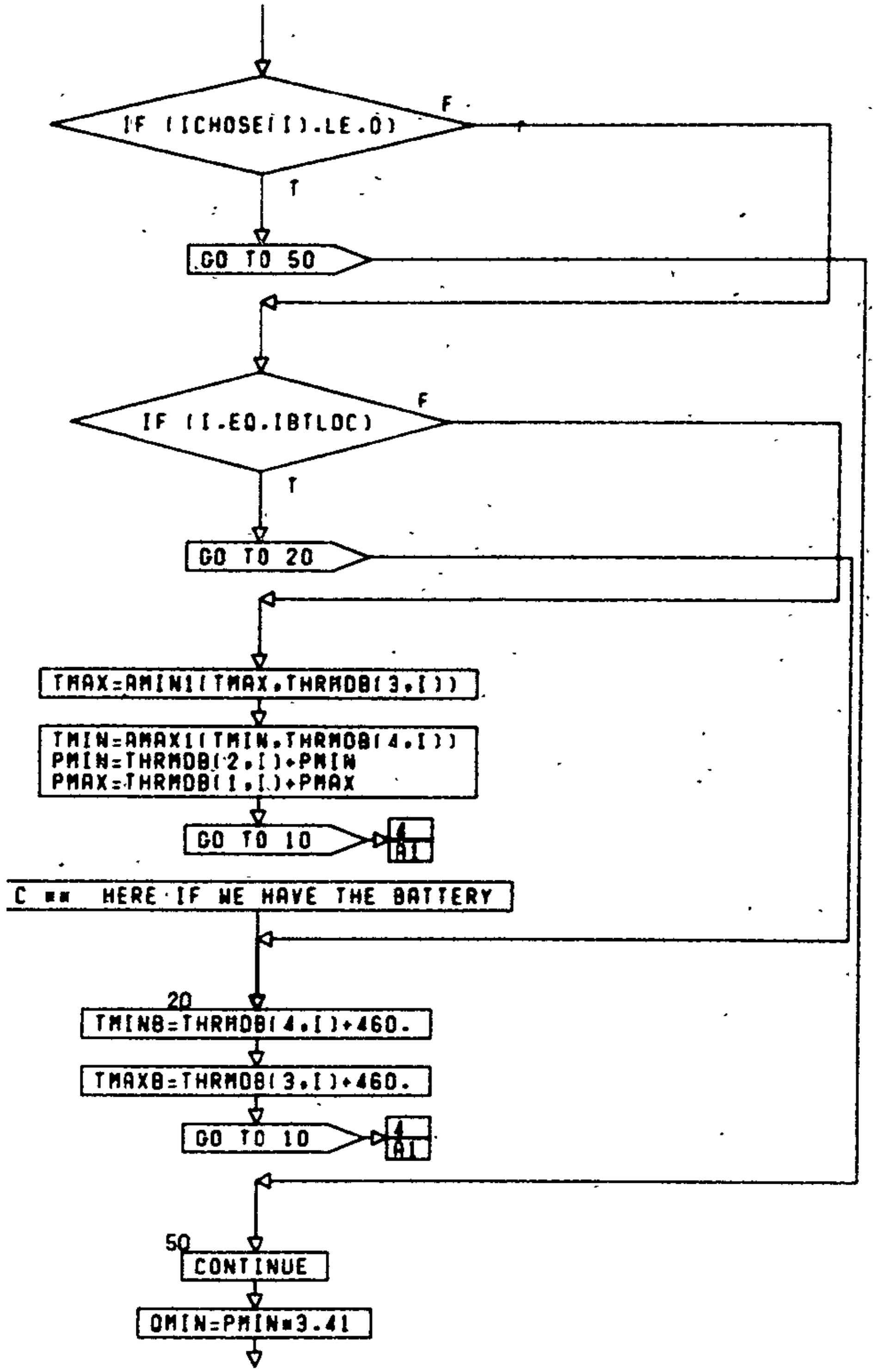
```
HTPT=0.
TMAX=1.E+20
TMIN=-1.E20
PMAX=0.
PMIN=0.0
ETAT=1.0
I=0
SATRAD=.5*D
```

A1 5

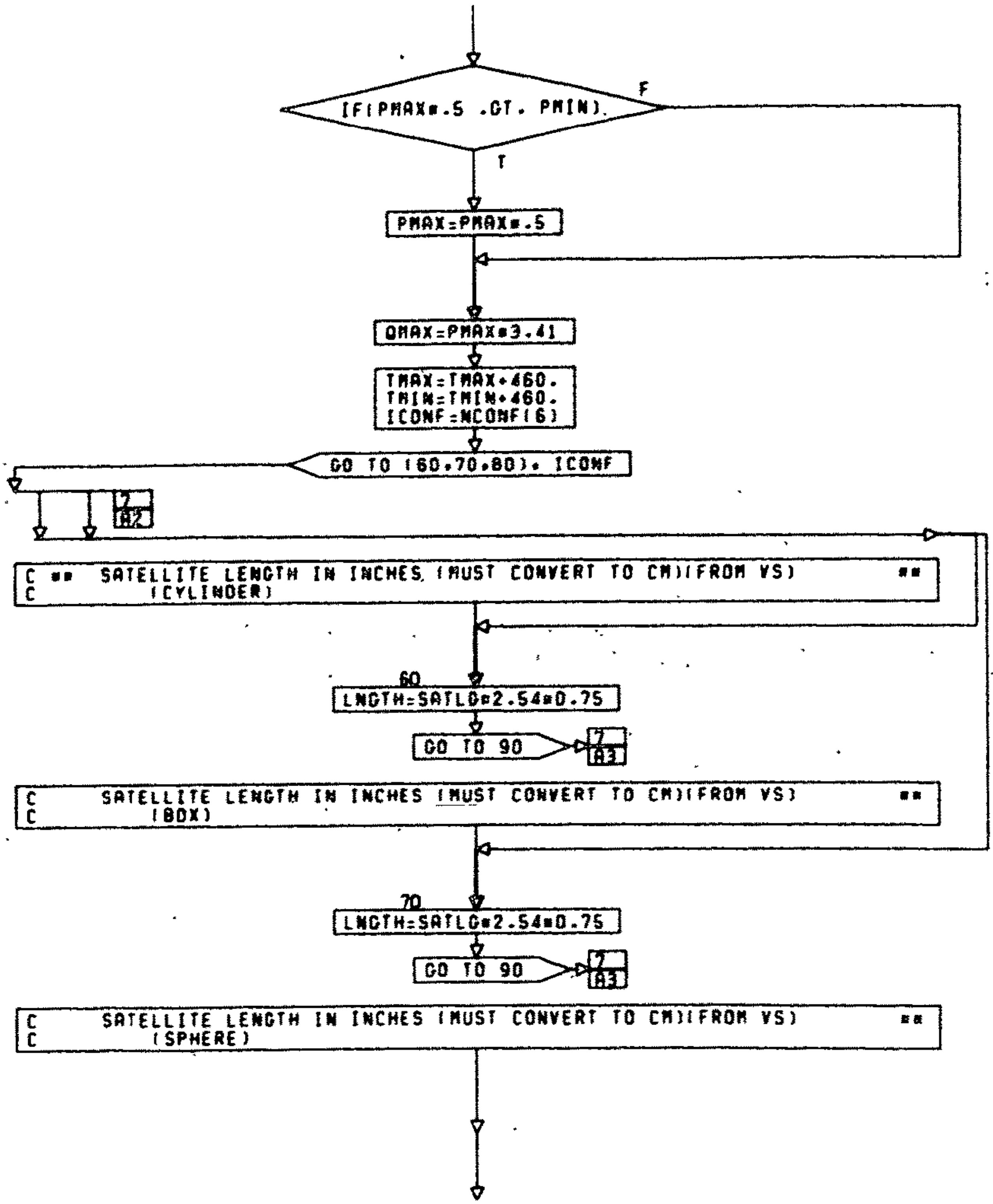
```
10
I=I+1
```

```
C          SEARCH FOR MIN(MAX TEMP) AND MAX(MIN TEMP), AND
C          ACCUMULATE THE POWER (EXCLUDING XMTRS AND BATTERIES)
```

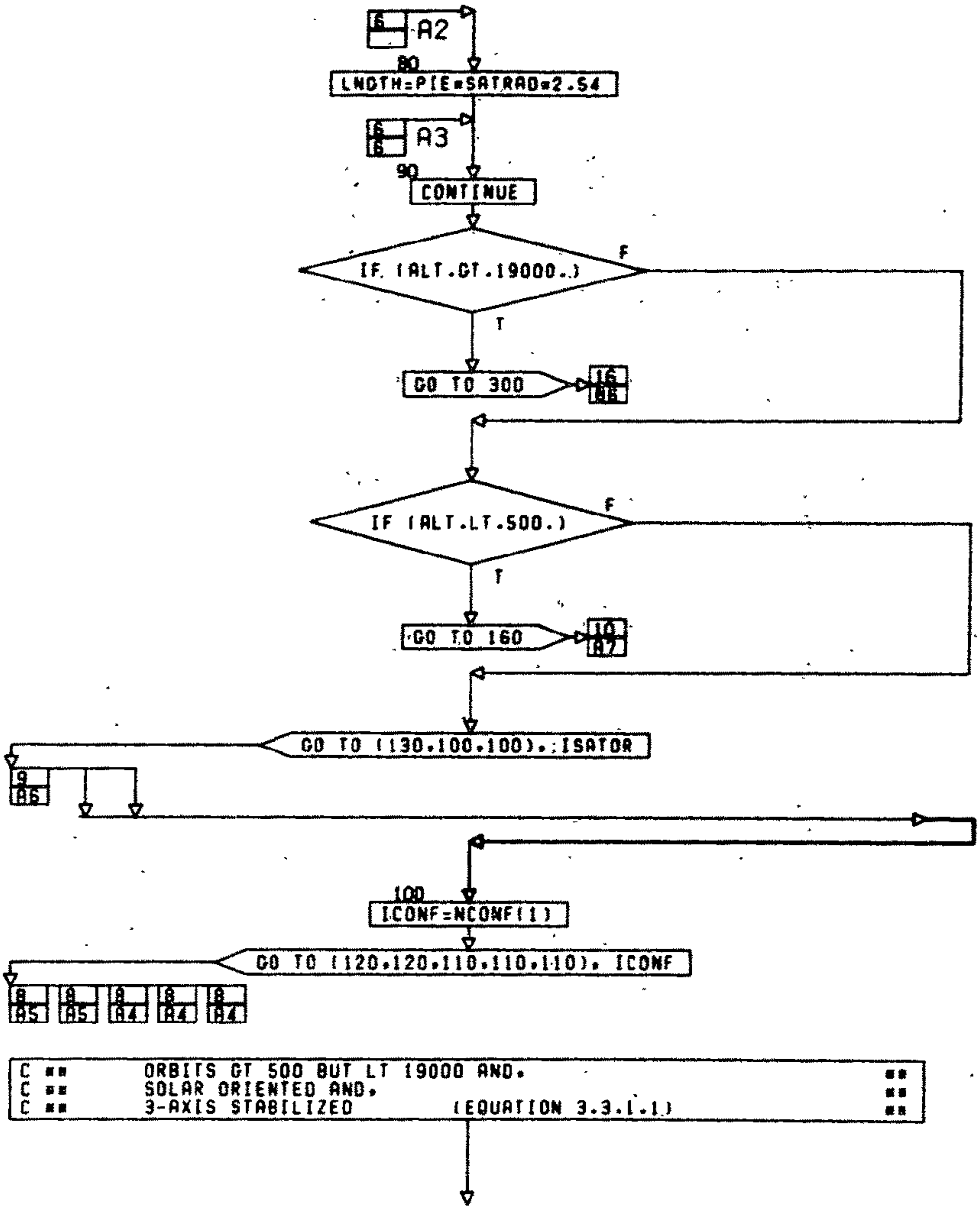
CONT. ON PG 5


IF (ICHOSE(I).LE.0)
F
T
GO TO 50
IF (I.EQ.IBTLOC)
F
T
GO TO 20
TMAX=AMIN1(TMAX,THRMDB(3,I))
TMIN=AMAX1(TMIN,THRMDB(4,I))
PMIN=THRMDB(2,I)+PMIN
PMAX=THRMDB(1,I)+PMAX
GO TO 10
4
A1
C ** HERE IF WE HAVE THE BATTERY
20
TMINB=THRMDB(4,I)+460.
TMAXB=THRMDB(3,I)+460.
GO TO 10
4
A1
50
CONTINUE
QMIN=PMIN*3.41

CONT. ON PG 6


IF(PMAX*.5 .GT. PMIN)
F
T
PMAX=PMAX*.5
QMAX=PMAX*3.41
TMAX=TMAX+460.
TMIN=TMIN+460.
ICONF=NCONF(6)
GO TO (60,70,80), ICONF
7
A2
C ** SATELLITE LENGTH IN INCHES (MUST CONVERT TO CM)(FROM VS) **
C (CYLINDER)
60
LNGTH=SATLG*2.54*0.75
GO TO 90
7
A3
C SATELLITE LENGTH IN INCHES (MUST CONVERT TO CM)(FROM VS) **
C (BOX)
70
LNGTH=SATLG*2.54*0.75
GO TO 90
7
A3
C SATELLITE LENGTH IN INCHES (MUST CONVERT TO CM)(FROM VS) **
C (SPHERE)

CONT. ON PG 7

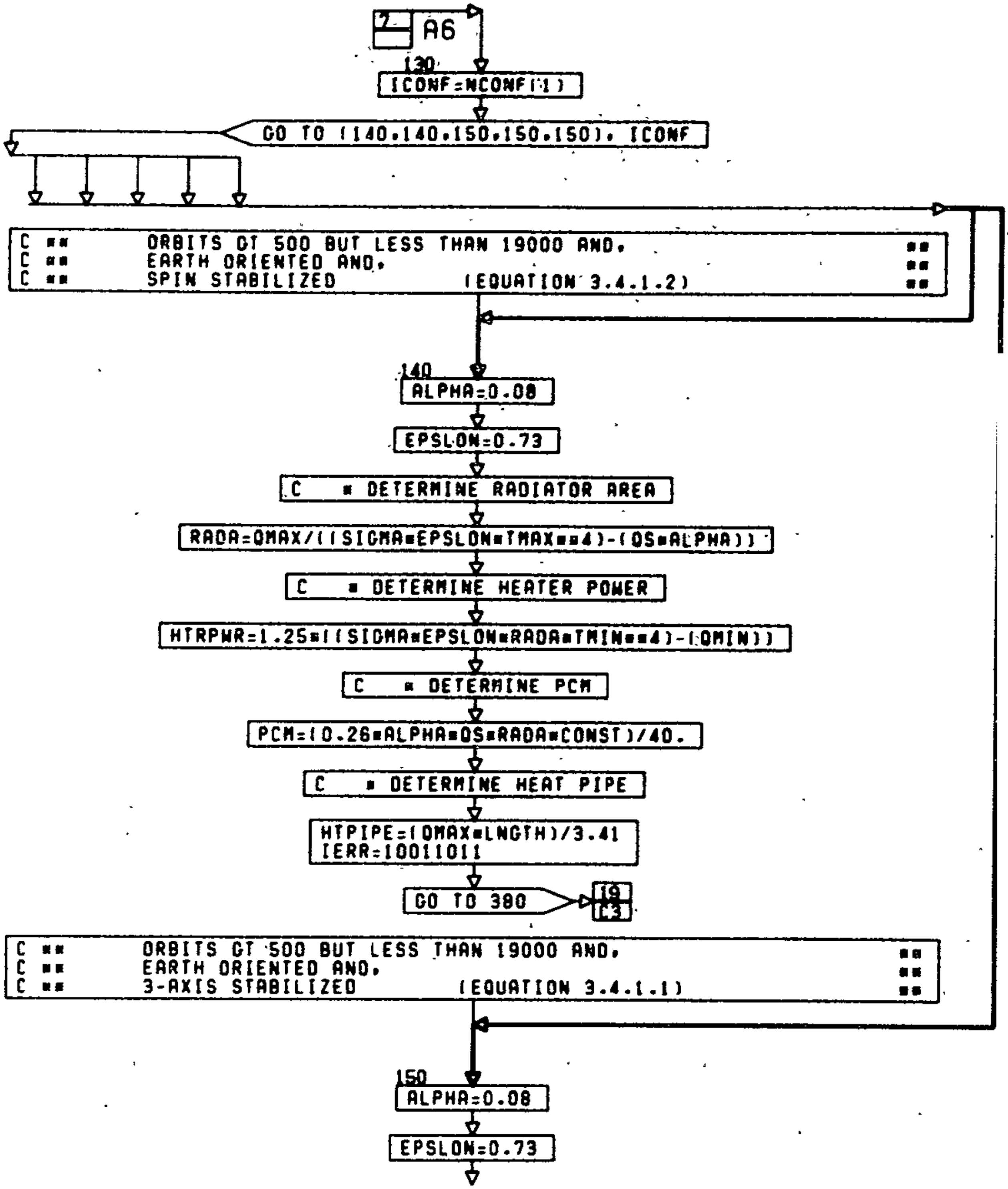


A2
80
LNGTH=PIE*SATRAD*2.54
A3
90
CONTINUE
IF (ALT.GT.19000.)
F
T
GO TO 300
16
A8
IF (ALT.LT.500.)
F
T
GO TO 160
10
A7
GO TO (130,100,100), ISATOR
9
A6
100
ICONF=NCONF(1)
GO TO (120,120,110,110,110), ICONF
8
A5
8
A5
8
A4
8
A4
8
A4
C ** ORBITS GT 500 BUT LT 19000 AND, **
C ** SOLAR ORIENTED AND, **
C ** 3-AXIS STABILIZED (EQUATION 3.3.1.1) **

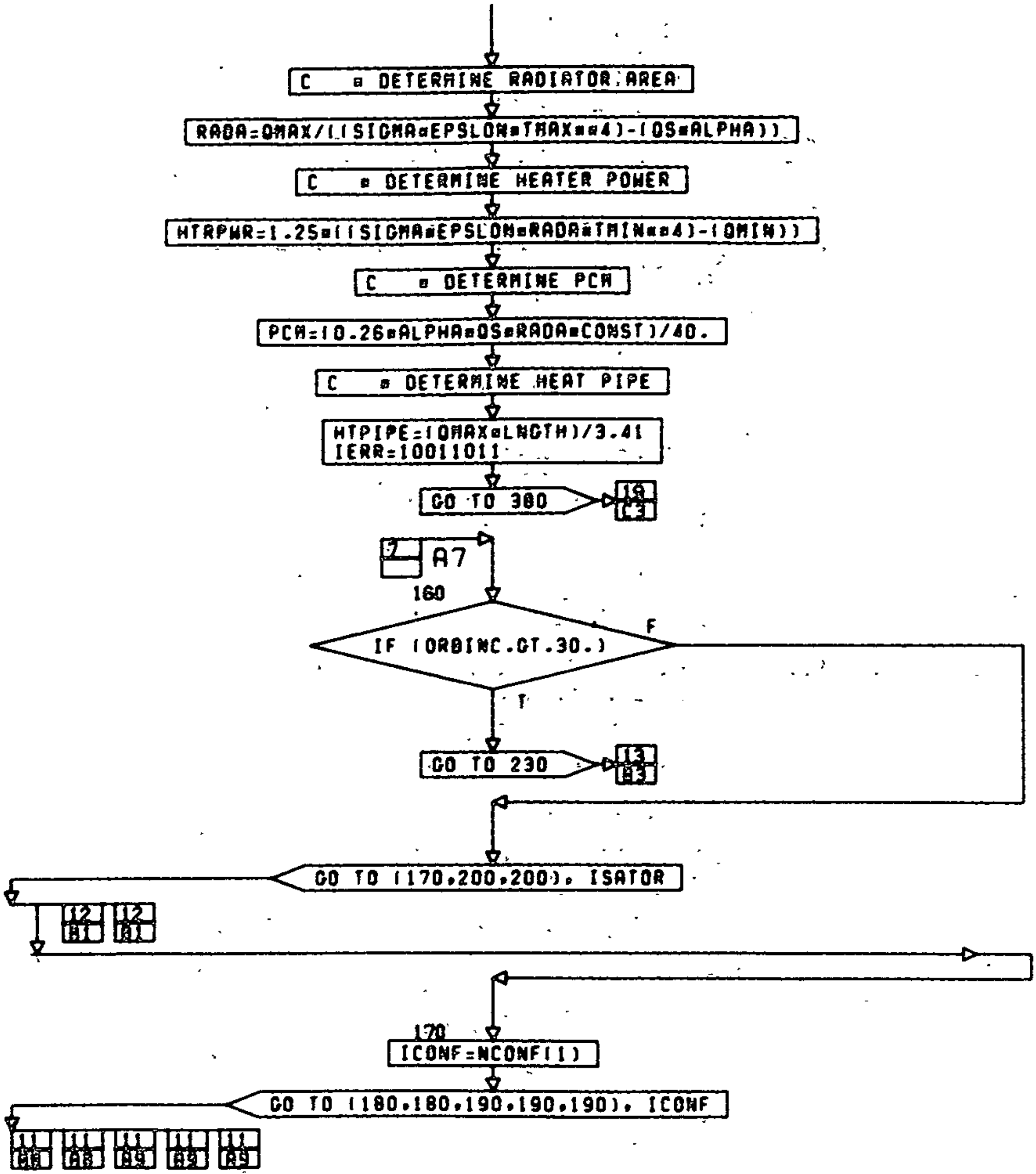
CONT. ON PG 8

```
        A4
110
ALPHA=0.30
EPSLON=0.75
C     * DETERMINE RADIATOR AREA
RADA=QMAX/(SIGMA*EPSLON*TMAX**4-(EMISS*EPSLON))
C     * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN)-(EMISS*EPSLON))
C     * DETERMINE HEAT PIPE
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10111
GO TO 380                                  19
                                           C3
C **       ORBITS GT 500 BUT LT 19000 AND,                          **
C **       SOLAR ORIENTED AND,                                      **
C **       SPIN STABILIZED            (EQUATION 3.3.1.2)            **
        A5
120
ALPHA=0.3
EPSLON=0.75
C     * DETERMINE RADIATOR AREA
RADA=QMAX/(SIGMA*EPSLON*TMAX**4-(EMISS*EPSLON))
C     * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN)-(EMISS*EPSLON))
C     * DETERMINE HEAT PIPE
HTPIPE=((QMAX*LNGTH)/3.41)
IERR=10111
GO TO 380                                  19
                                           C3
```

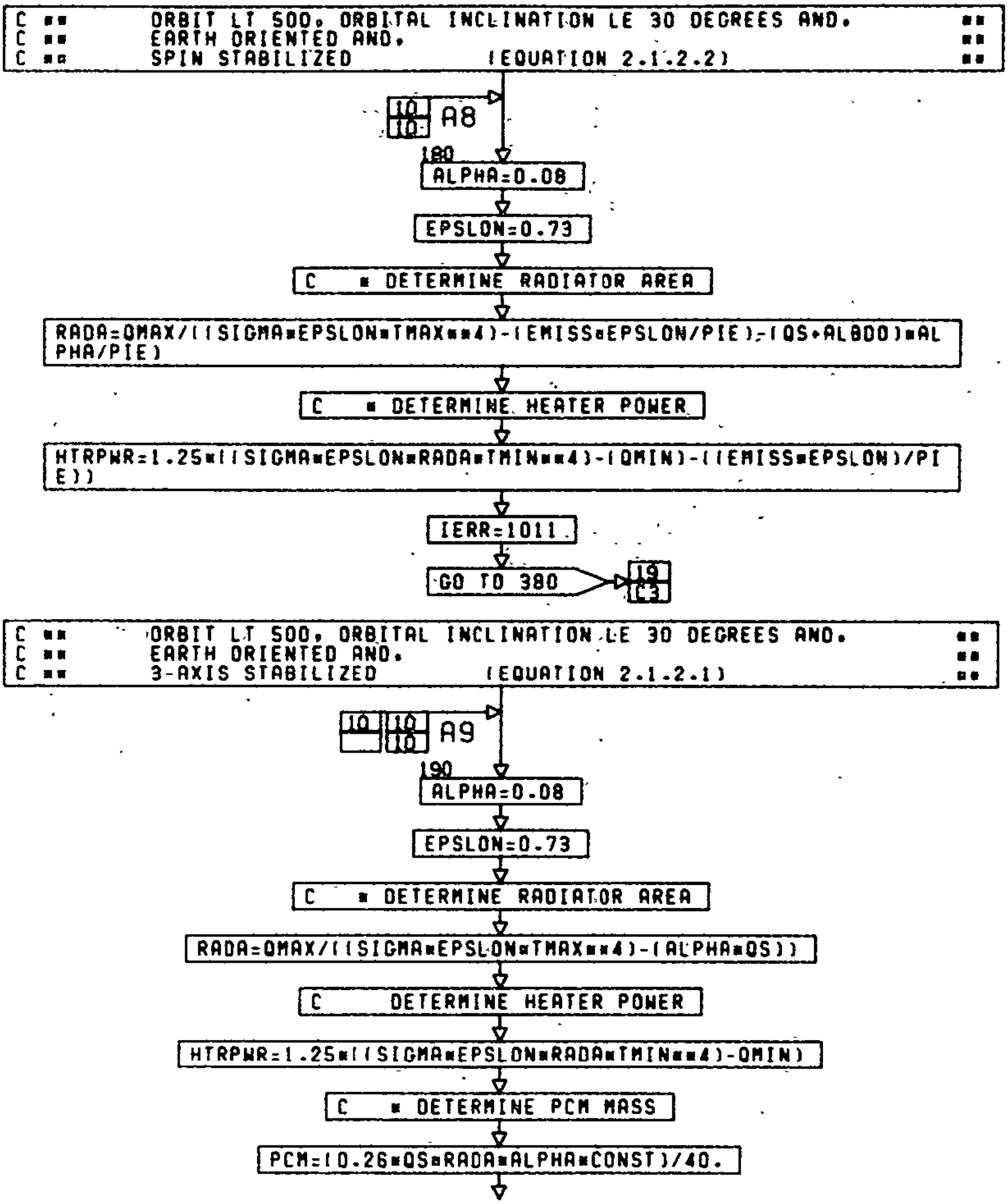
CONT. ON PG 9


7
A6
130
ICONF=NCONF(1)
GO TO (140,140,150,150,150), ICONF
C ** ORBITS GT 500 BUT LESS THAN 19000 AND, **
C ** EARTH ORIENTED AND, **
C ** SPIN STABILIZED (EQUATION 3.4.1.2) **
140
ALPHA=0.08
EPSLON=0.73
C * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(QS*ALPHA))
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN))
C * DETERMINE PCM
PCM=(0.26*ALPHA*QS*RADA*CONST)/40.
C * DETERMINE HEAT PIPE
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10011011
GO TO 380
19
C3
C ** ORBITS GT 500 BUT LESS THAN 19000 AND, **
C ** EARTH ORIENTED AND, **
C ** 3-AXIS STABILIZED (EQUATION 3.4.1.1) **
150
ALPHA=0.08
EPSLON=0.73

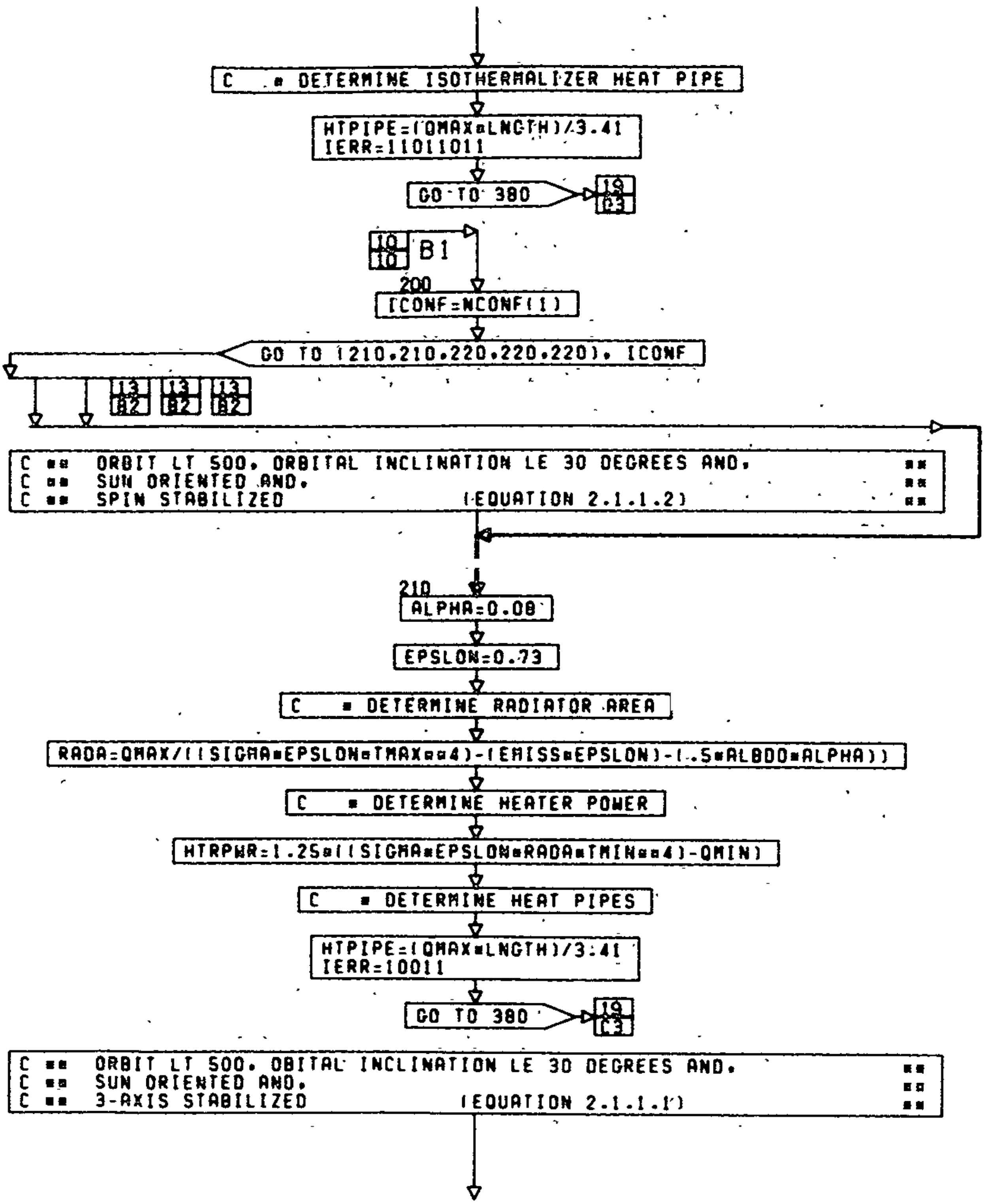
CONT. ON PG 10


C * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(QS*ALPHA))
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN))
C * DETERMINE PCM
PCM=(0.26*ALPHA*QS*RADA*CONST)/40.
C * DETERMINE HEAT PIPE
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10011011
GO TO 380
A7
160
IF (ORBINC.GT.30.)
F
T
GO TO 230
GO TO (170,200,200), ISATOR
170
ICONF=NCONF(1)
GO TO (180,180,190,190,190), ICONF

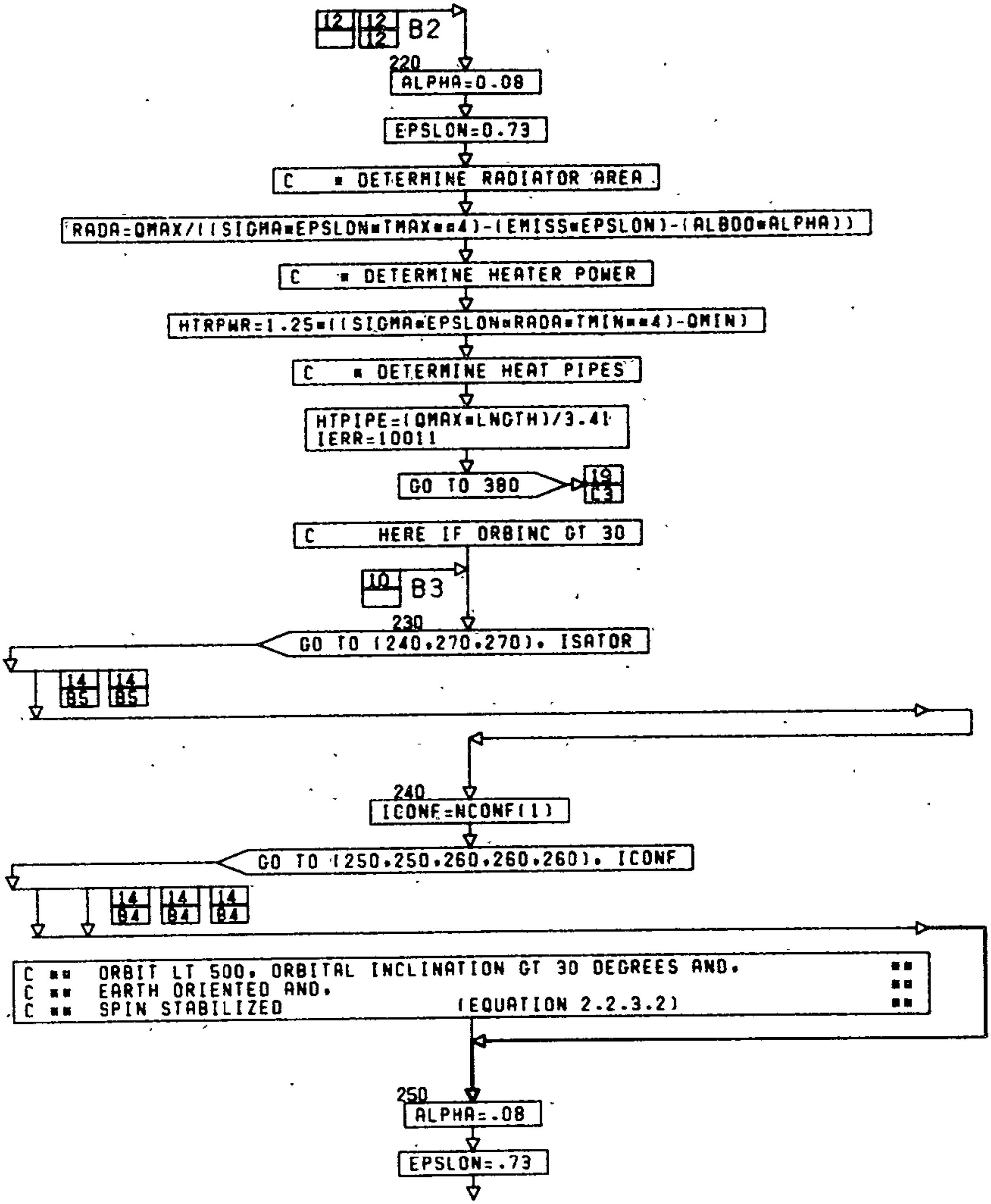
CONT. ON PG 11


C ** ORBIT LT 500, ORBITAL INCLINATION LE 30 DEGREES AND. **
C ** EARTH ORIENTED AND, **
C ** SPIN STABILIZED (EQUATION 2.1.2.2) **
10
10
A8
180
ALPHA=0.08
EPSLON=0.73
C * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON/PIE)-(QS+ALBDO)*AL
PHA/PIE)
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-(QMIN)-((EMISS*EPSLON)/PI
E))
IERR=1011
GO TO 380
19
C3
C ** ORBIT LT 500, ORBITAL INCLINATION LE 30 DEGREES AND. **
C ** EARTH ORIENTED AND, **
C ** 3-AXIS STABILIZED (EQUATION 2.1.2.1) **
10
10
10
A9
190
ALPHA=0.08
EPSLON=0.73
C * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(ALPHA*QS))
C DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
C * DETERMINE PCM MASS
PCM=(0.26*QS*RADA*ALPHA*CONST)/40.

CONT. ON PG 12


C * DETERMINE ISOTHERMALIZER HEAT PIPE
HTPIPE=(QMAX*LNGTH)/3.41
IERR=11011011
GO TO 380
19
C3
10
10
B1
200
ICONF=NCONF(1)
GO TO (210,210,220,220,220), ICONF
13
B2
13
B2
13
B2
C ** ORBIT LT 500, ORBITAL INCLINATION LE 30 DEGREES AND, **
C ** SUN ORIENTED AND, **
C ** SPIN STABILIZED (EQUATION 2.1.1.2) **
210
ALPHA=0.08
EPSLON=0.73
C * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON)-(.5*ALBDO*ALPHA))
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
C * DETERMINE HEAT PIPES
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10011
GO TO 380
19
C3
C ** ORBIT LT 500, OBITAL INCLINATION LE 30 DEGREES AND, **
C ** SUN ORIENTED AND, **
C ** 3-AXIS STABILIZED (EQUATION 2.1.1.1) **

CONT. ON PG 13


12
12
12
B2
220
ALPHA=0.08
EPSLON=0.73
C * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON)-(ALBDO*ALPHA))
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
C * DETERMINE HEAT PIPES
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10011
GO TO 380
19
C3
C HERE IF ORBINC GT 30
10
B3
230
GO TO (240,270,270), ISATOR
14
B5
14
B5
240
ICONF=NCONF(1)
GO TO (250,250,260,260,260), ICONF
14
B4
14
B4
14
B4
C ** ORBIT LT 500, ORBITAL INCLINATION GT 30 DEGREES AND, **
C ** EARTH ORIENTED AND, **
C ** SPIN STABILIZED (EQUATION 2.2.3.2) **
250
ALPHA=.08
EPSLON=.73

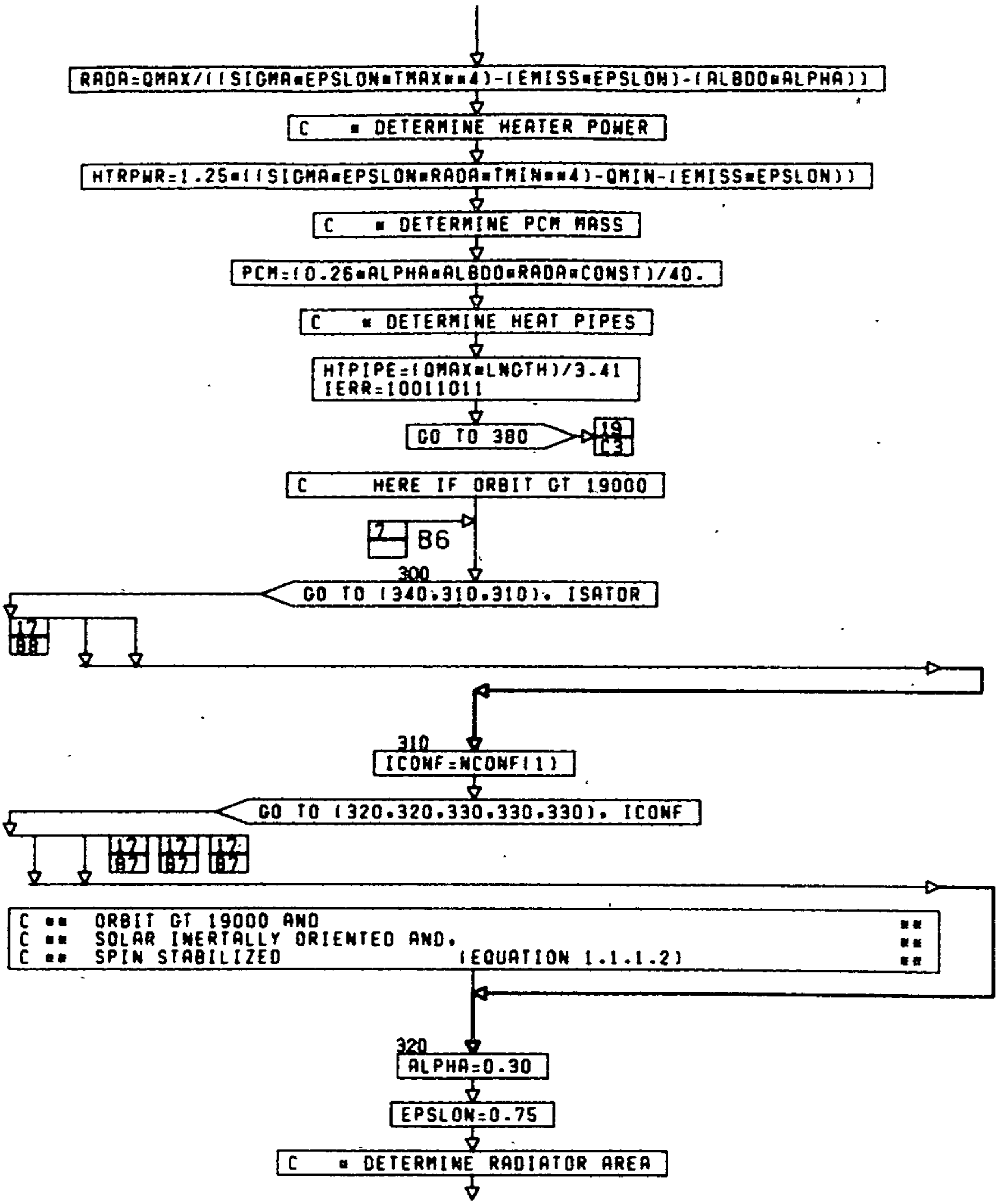
CONT. ON PG 14

```
C    * DETERMINE RADIATOR AREA

RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON/PIE)-((QS+ALBDO)*A
LPHA/PIE))

C    * DETERMINE HEATER POWER

HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN-(EMISS*EPSLON/PIE))
IERR=1011

GO TO 380  -> 19 C3

C **  ORBIT LT 500, ORBITAL INCLINATION GT 30 AND,              **
C **  EARTH ORIENTED AND,                                       **
C **  3-AXIS STABILIZED              (EQUATION 2.2.3.1)         **

13 | 13 13  B4

260
ALPHA=.08

EPSLON=.73

C    * DETERMINE RADIATOR AREA

RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(ALPHA*QS))

C    * DETERMINE HEATER POWER

HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)

C    * DETERMINE PCM MASS

PCM=(0.26*QS*ALPHA*RADA*CONST)/40.

C      DETERMINE ISOTHERMALIZER HEAT PIPE

HTPIPE=(QMAX*LNGTH)/3.41
IERR=11011011

GO TO 380  -> 19 C3

13 13  B5

270
ICONF=NCONF(1)
```

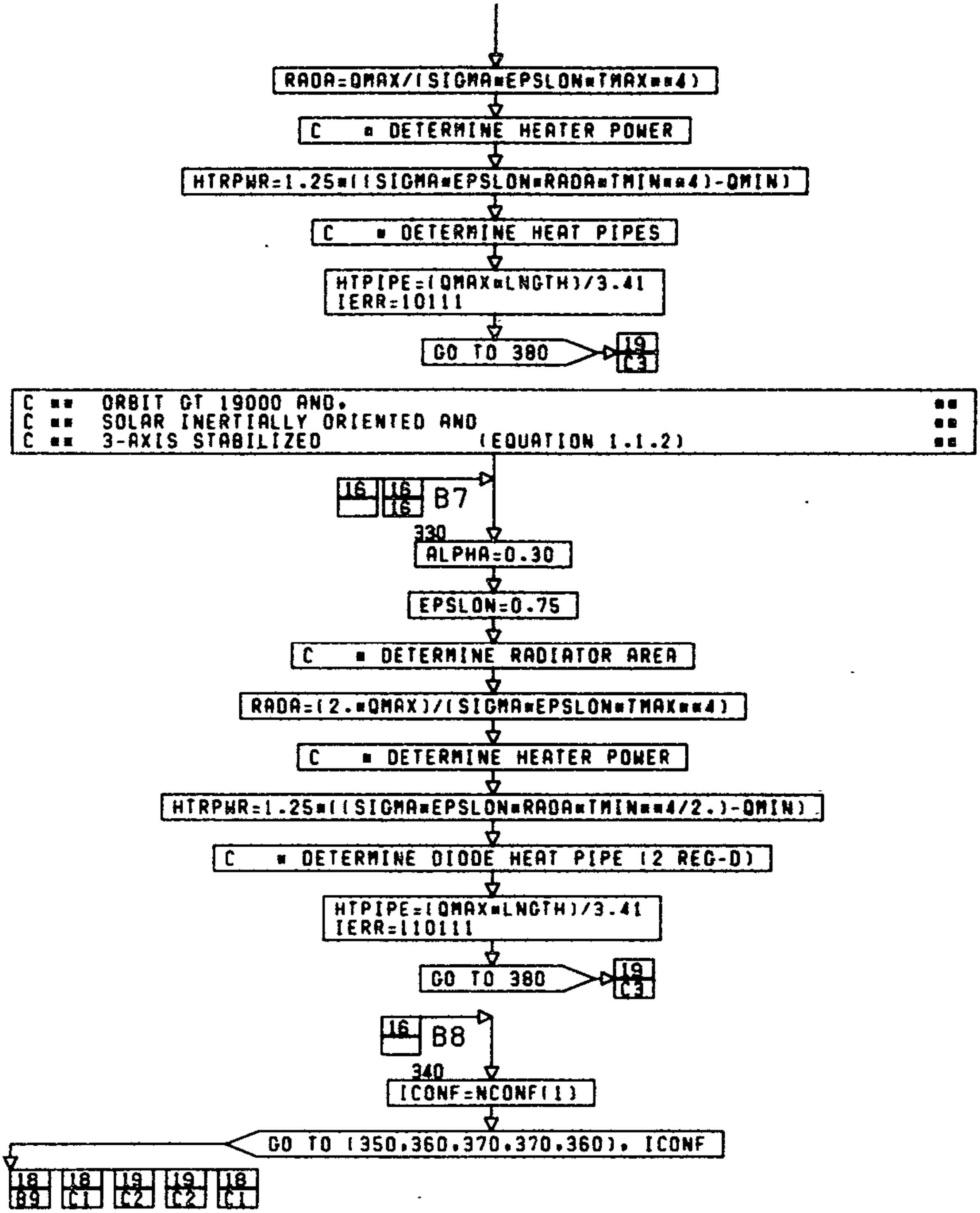
CONT. ON PG 15

```
GO TO (280,280,290,290,290), ICONF

C **   ORBIT LT 500, ORBITAL INCLINATION GT 30 AND.                **
C **   SUN ORIENTED AND.                                            **
C **   SPIN STABILIZED                 (EQUATION 2.2.2.2)           **

280
ALPHA=.08
EPSLON=.73
C    * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON)-(ALBDO*ALPHA))
C    * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN-(EMISS*EPSLON))
C    * DETERMINE PCM MASS
PCM=(0.26*ALPHA*ALBDO*RADA*CONST)/40.
C    * DETERMINE HEAT PIPES
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10011011
GO TO 380      19 C3

C **   ORBIT LT 500, ORBITAL INCLINATION GT 30 DEGREES
C **   SUN ORIENTED AND.
C **   3-AXIS STABILIZED              (EQUATION 2.2.2.1)

290
ALPHA=0.08
EPSLON=0.73
C    * DETERMINE RADIATOR AREA
```

CONT. ON PG 16


RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(EMISS*EPSLON)-(ALBDO*ALPHA))
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN-(EMISS*EPSLON))
C * DETERMINE PCM MASS
PCM=(0.26*ALPHA*ALBDO*RADA*CONST)/40.
C * DETERMINE HEAT PIPES
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10011011
GO TO 380
19
C3
C HERE IF ORBIT GT 19000
7
B6
300
GO TO (340,310,310), ISATOR
17
B8
310
ICONF=NCONF(1)
GO TO (320,320,330,330,330), ICONF
17
B7
17
B7
17
B7
C ** ORBIT GT 19000 AND **
C ** SOLAR INERTALLY ORIENTED AND, **
C ** SPIN STABILIZED (EQUATION 1.1.1.2) **
320
ALPHA=0.30
EPSLON=0.75
C * DETERMINE RADIATOR AREA

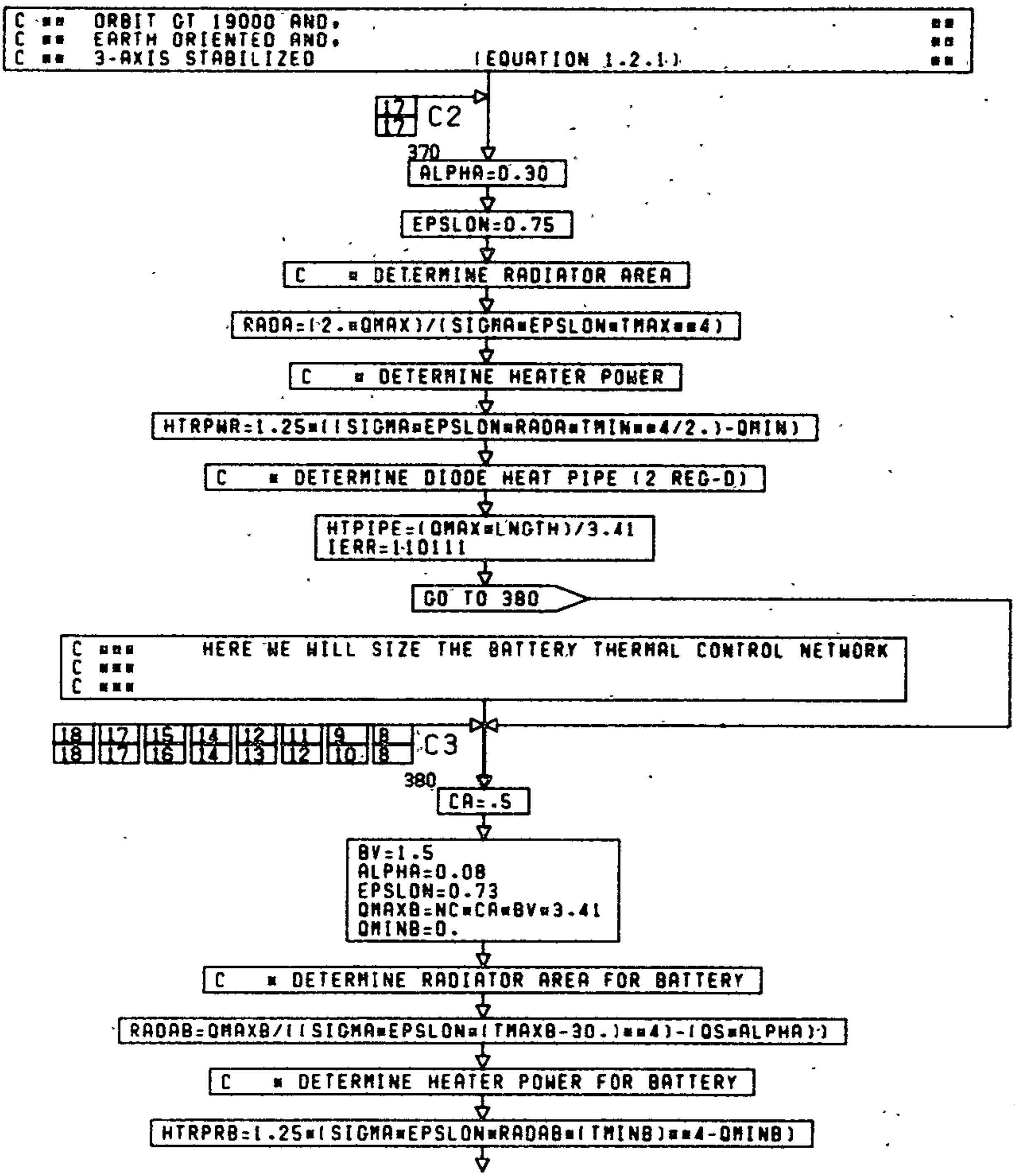
CONT. ON PG 17


RADA=QMAX/(SIGMA*EPSLON*TMAX**4)
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
C * DETERMINE HEAT PIPES
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10111
GO TO 380
19
C3
C ** ORBIT GT 19000 AND. **
C ** SOLAR INERTIALLY ORIENTED AND **
C ** 3-AXIS STABILIZED (EQUATION 1.1.2) **
16
16
16
B7
330
ALPHA=0.30
EPSLON=0.75
C * DETERMINE RADIATOR AREA
RADA=(2.*QMAX)/(SIGMA*EPSLON*TMAX**4)
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4/2.)-QMIN)
C * DETERMINE DIODE HEAT PIPE (2 REG-D)
HTPIPE=(QMAX*LNGTH)/3.41
IERR=110111
GO TO 380
19
C3
16
B8
340
ICONF=NCONF(1)
GO TO (350,360,370,370,360), ICONF
18
B9
18
C1
19
C2
19
C2
18
C1

CONT. ON PG 18

```
C **  ORBIT GT 19000 AND.                                          **
C **  EARTH ORIENTED AND.                                          **
C **  DUAL OR NORMAL SPIN STABILIZED(EQUATION 1.2.3)               **

17 B9
350 ALPHA=0.30
EPSLON=0.75
C    * DETERMINE RADIATOR AREA
RADA=QMAX/(SIGMA*EPSLON*TMAX**4)
C    * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
C    * DETERMINE HEAT PIPES
HTPIPE=(QMAX*LNGTH)/3.41
IERR=10111
GO TO 380            19 C3

C **  ORBIT GT 19000 AND                                            **
C **  YAW SPIN STABILIZED               (EQUATION 1.2.2)           **

17 17 C1
360 ALPHA=0.08
EPSLON=0.73
C    * DETERMINE RADIATOR AREA
RADA=QMAX/((SIGMA*EPSLON*TMAX**4)-(QS*ALPHA/PIE))
C    * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4)-QMIN)
IERR=1011
GO TO 380            19 C3
```

CONT. ON PG 19


C ** ORBIT GT 19000 AND. **
C ** EARTH ORIENTED AND. **
C ** 3-AXIS STABILIZED (EQUATION 1.2.1) **
17 17 C2
370
ALPHA=0.30
EPSLON=0.75
C * DETERMINE RADIATOR AREA
RADA=(2.*QMAX)/(SIGMA*EPSLON*TMAX**4)
C * DETERMINE HEATER POWER
HTRPWR=1.25*((SIGMA*EPSLON*RADA*TMIN**4/2.)-QMIN)
C * DETERMINE DIODE HEAT PIPE (2 REG-D)
HTPIPE=(QMAX*LNGTH)/3.41
IERR=110111
GO TO 380
C *** HERE WE WILL SIZE THE BATTERY THERMAL CONTROL NETWORK
C ***
C ***
18 18 17 17 15 16 14 14 12 13 11 12 9 10 8 8 C3
380
CA=.5
BV=1.5
ALPHA=0.08
EPSLON=0.73
QMAXB=NC*CA*BV*3.41
QMINB=0.
C * DETERMINE RADIATOR AREA FOR BATTERY
RADAB=QMAXB/((SIGMA*EPSLON*(TMAXB-30.)**4)-(QS*ALPHA))
C * DETERMINE HEATER POWER FOR BATTERY
HTRPRB=1.25*(SIGMA*EPSLON*RADAB*(TMINB)**4-QMINB)

CONT. ON PG 20

```
C    * DETERMINE VARIABLE CONDUCTANCE HEAT PIPE

VCHP=QMAXB*LNGTH/3.41
IERR=IERR+1100000000
HTPIPE = HTPIPE / 2.54
VCHP = VCHP / 2.54
RAT=RADA+RADAB
HPT=HTRPWR+HTRPRB
HTPT=HTPIPE+VCHP

RETURN

END
```

PG 20 FINAL

```
SUBROUTINE COMM (IPIC,IERR,ITER,MCONF,ICHOSE,NCHOSE)
INTEGER RESET,SEO,SSS,GRP
REAL LMARG,NF,MODLOS,IBER
```

```
DIMENSION IPIC(9),ICHOSE(11),NCHOSE(11),KPIC(9),MCONF(6),
 KCHOSE(11),PW(2),ISPFLG(2),J2SAVE(2)
```

```
DIMENSION SIGNOI(2),LMARG(2),TCLOSS(2),GT(2),MODX(2)
DIMENSION BER(14,3),IBER(14),BESSJ(2),LIMPIC(9)
```

```
COMMON /USER4/BWIDTH(2),   FREQX(2),    FREQR,IOPTCM(3),     LINK,
                 NADIR,      NET
```

```
COMMON /USER1/     APOGEE,    COMRAT,     DIAMAX, EEQWT(9),      EPME,
                   EQM1WT,    EQM1XL,     EQM1YL,   EQM1ZL,    EQM2WT,
                   EQM2XL,    EQM2YL,     EQM2ZL,       FE,    IAGNCY,
      IDEBUG,         SEO,    MB12SH,     OPTEMP,   ORBINC,    PERIGE,
       MICRO,       RELME,   SPEC(6),      SPEC1,    XDUM1,    XCGSA1,
                     XMER,      XMEU
```

```
COMMON /BTWN/       ACSSN,     ACSWP,        ALT,     AREA,    BATCAP,
                BITRAT(2),     CLIFE,     CONVWT,        D,        DT,
                       DX,        DY,         DZ,    EQBLG,    EQBSID,
                       FC,        FF,     HARNWT,      HPT,    HTPIPE,
                     HTPT,    HTRPRB,     HTRPWR,               IBTLOC,
                    LMBDD,        NC,      OMEGS,  PASSTR,         PJ,
                       PL,     PLMIN,     POCNWT,     RADA,     RADAB,
                      RAT,        RJ,     SABOLG,    SATLG,    SATTWT,
```

```
                    SATWT,    SATXCG,     SATYCG,   SATZCG,     SA1XL,
                    SA1YL,     SA1ZL,       SIDE,    SYSLB,    THCMWT,
                THRUST(2),        TI,      TNKWT,    TPRIM,        VB,
                     VCHP,       VOL,       WATE,       WB,       WBT,
                       WT,        XJ,     XNZERO,       YJ,        ZJ
```

```
COMMON /DBCOM/DATAB(55,100),IDB(30)
```

```
EQUIVALENCE (J1,KPIC(1)), (J7,KPIC(6)), (J4,KPIC(7)), (J5,KPIC(8))
, (J6,KPIC(9))
```

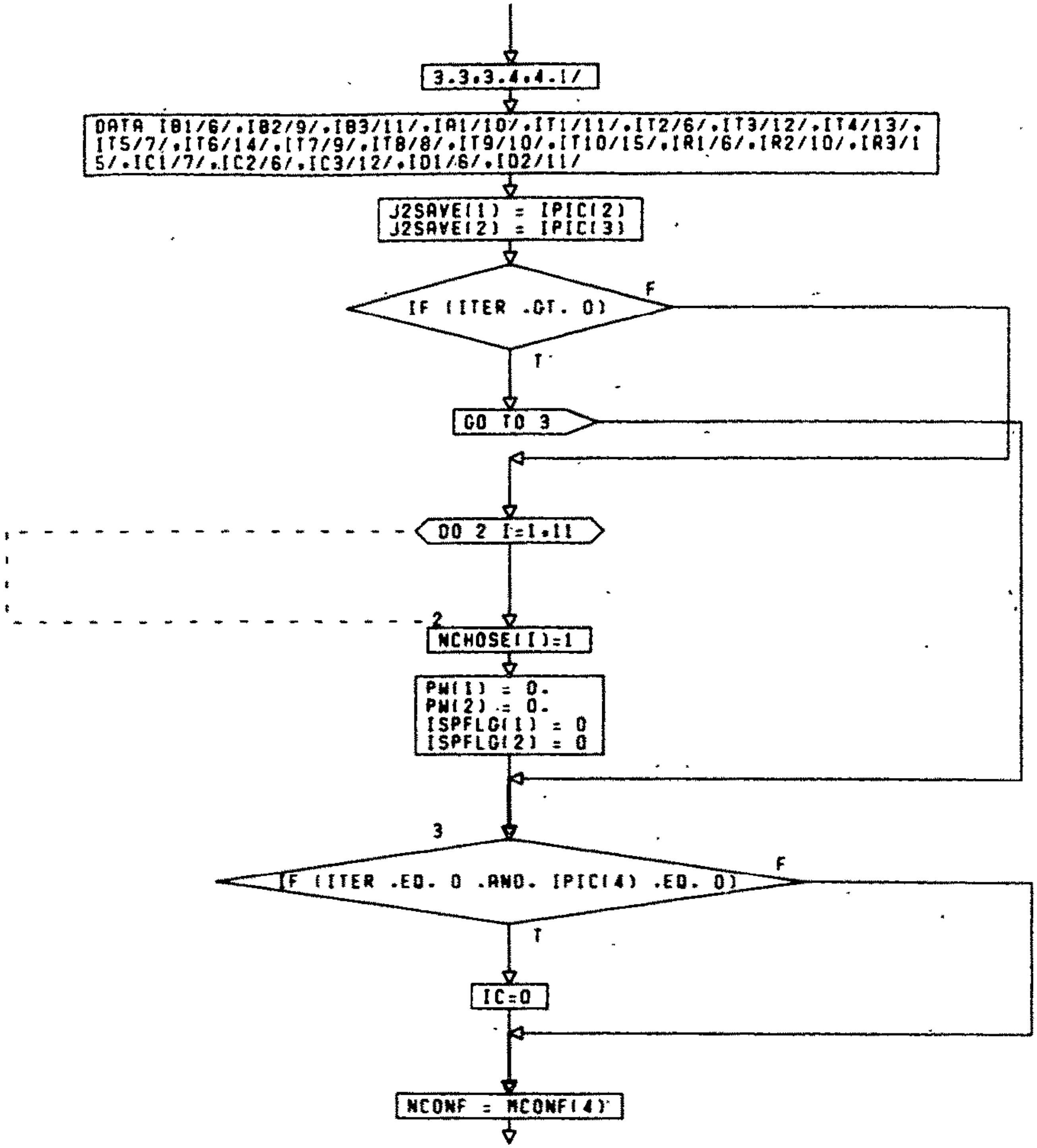
```
DATA    SIGNOI /10.,10./,  LMARG   /6.,6./, SLANT /-1.E10/,
        GTOT /-1.E10/, GR/-1.E10/, T/-1.E10/, NF /-1.E10/,
        TCLOSS / 0.,0./, POLOSS /0./, GAMMA /.1/, BETA /1.8/,
        GT /-1.E10,-1.E10/,  MODX /0.0/, ANTLOS /0./,
        COVER /0./,GRP /0/
```

```
C BER IS BIT ERROR RATE DEGRADATION DUE TO HARDWARE
C IBER IS ARRAY OF DATA RATES
```

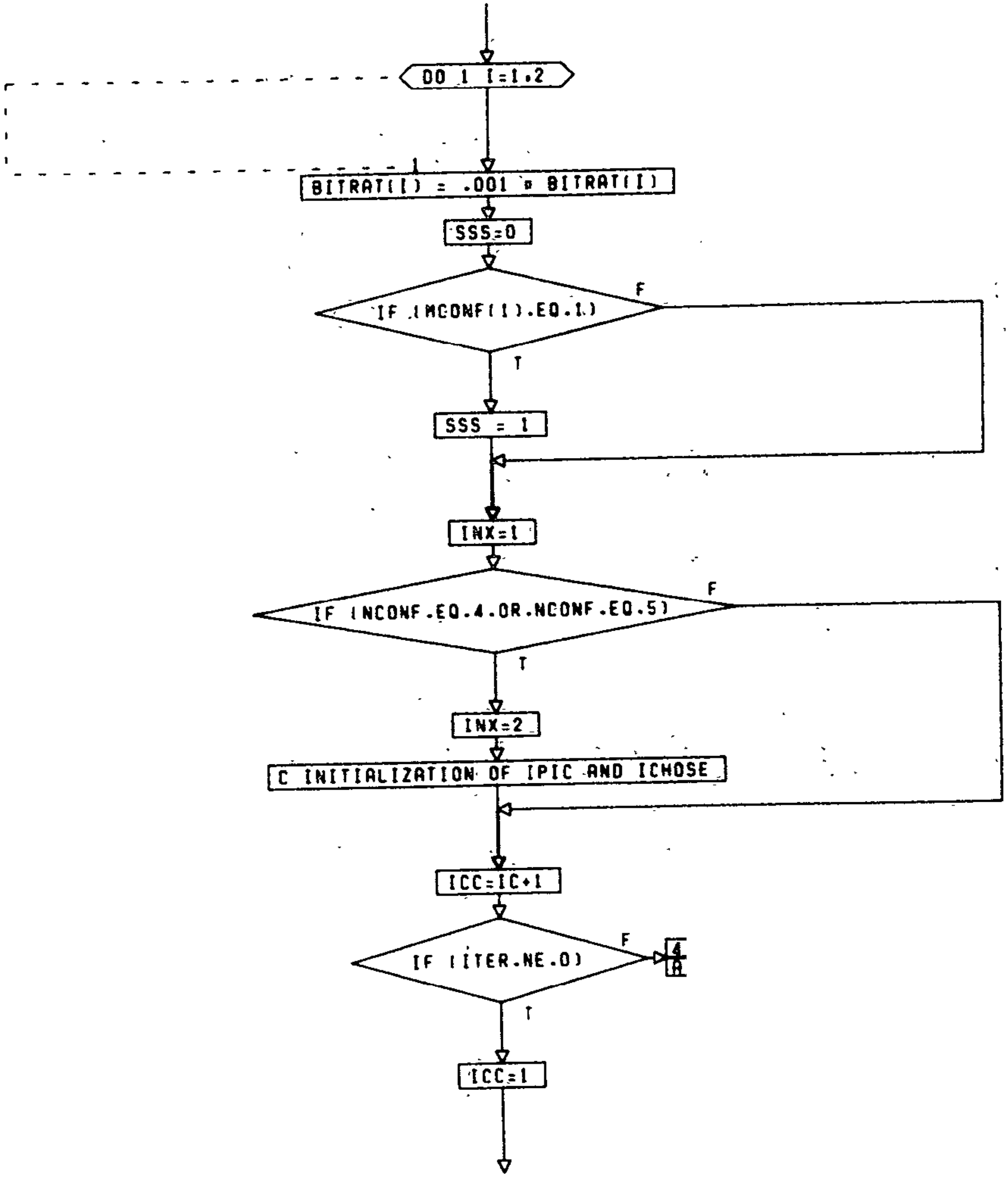
```
DATA IBER/.25,.50,1.0,2.0,4.0,8.0,16.,32.,64.,128.,256.,512.,768.,
1024./
```

```
DATA BER/8*4.4,4.6,5*5.5,8*2.4,2.4,2.5,4*3.3,10*4.0,3.9,
```

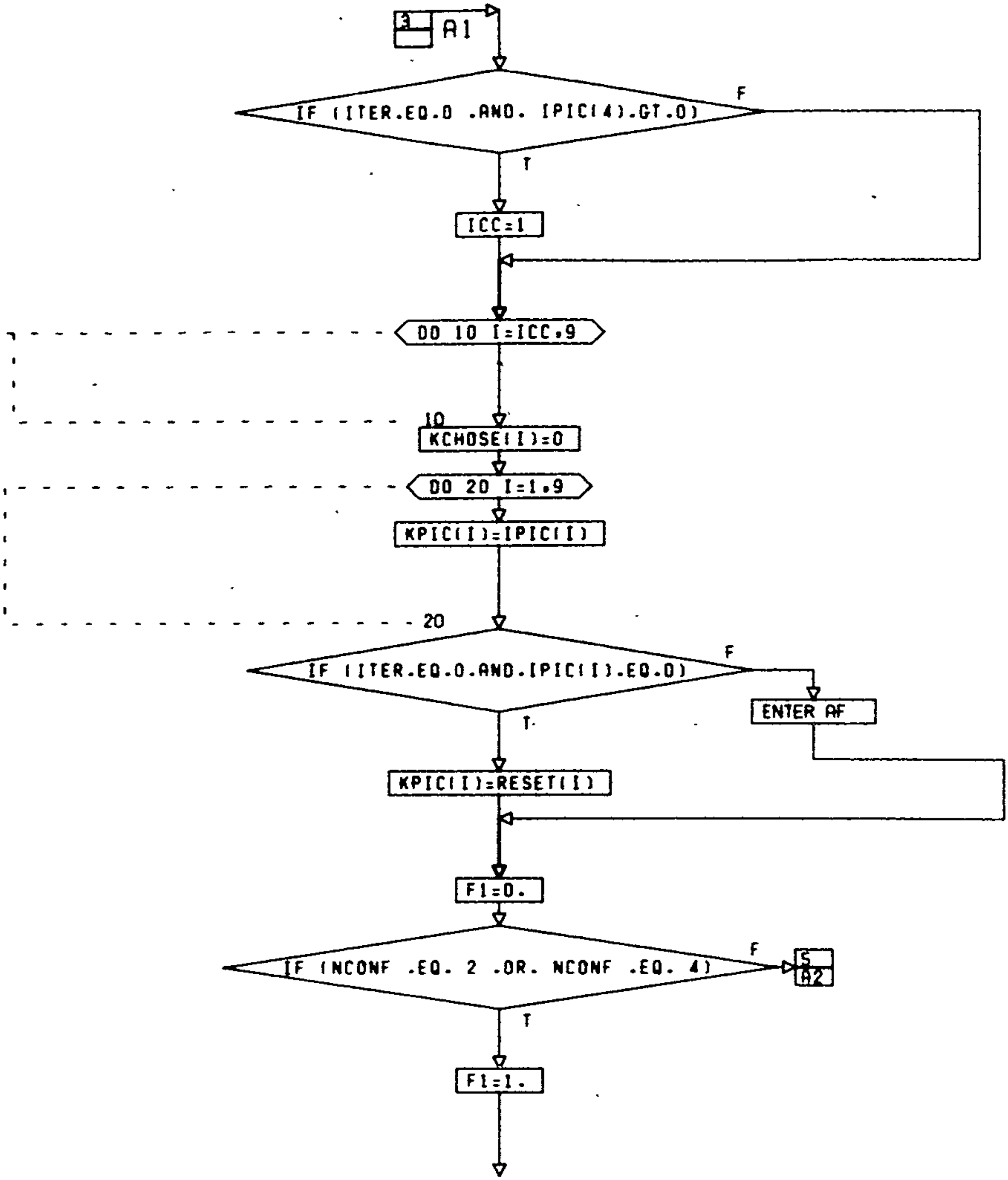
CONT. ON PG 2


3.3.3.4.4.1/
DATA IB1/6/,IB2/9/,IB3/11/,IA1/10/,IT1/11/,IT2/6/,IT3/12/,IT4/13/,IT5/7/,IT6/14/,IT7/9/,IT8/8/,IT9/10/,IT10/15/,IR1/6/,IR2/10/,IR3/15/,IC1/7/,IC2/6/,IC3/12/,ID1/6/,ID2/11/
J2SAVE(1) = IPIC(2)
J2SAVE(2) = IPIC(3)
IF (ITER .GT. 0)
F
T
GO TO 3
DO 2 I=1,11
2
NCHOSE(I)=1
PW(1) = 0.
PW(2) = 0.
ISPFLG(1) = 0
ISPFLG(2) = 0
3
IF (ITER .EQ. 0 .AND. IPIC(4) .EQ. 0)
F
T
IC=0
NCONF = NCONF(4)

CONT. ON PG 3

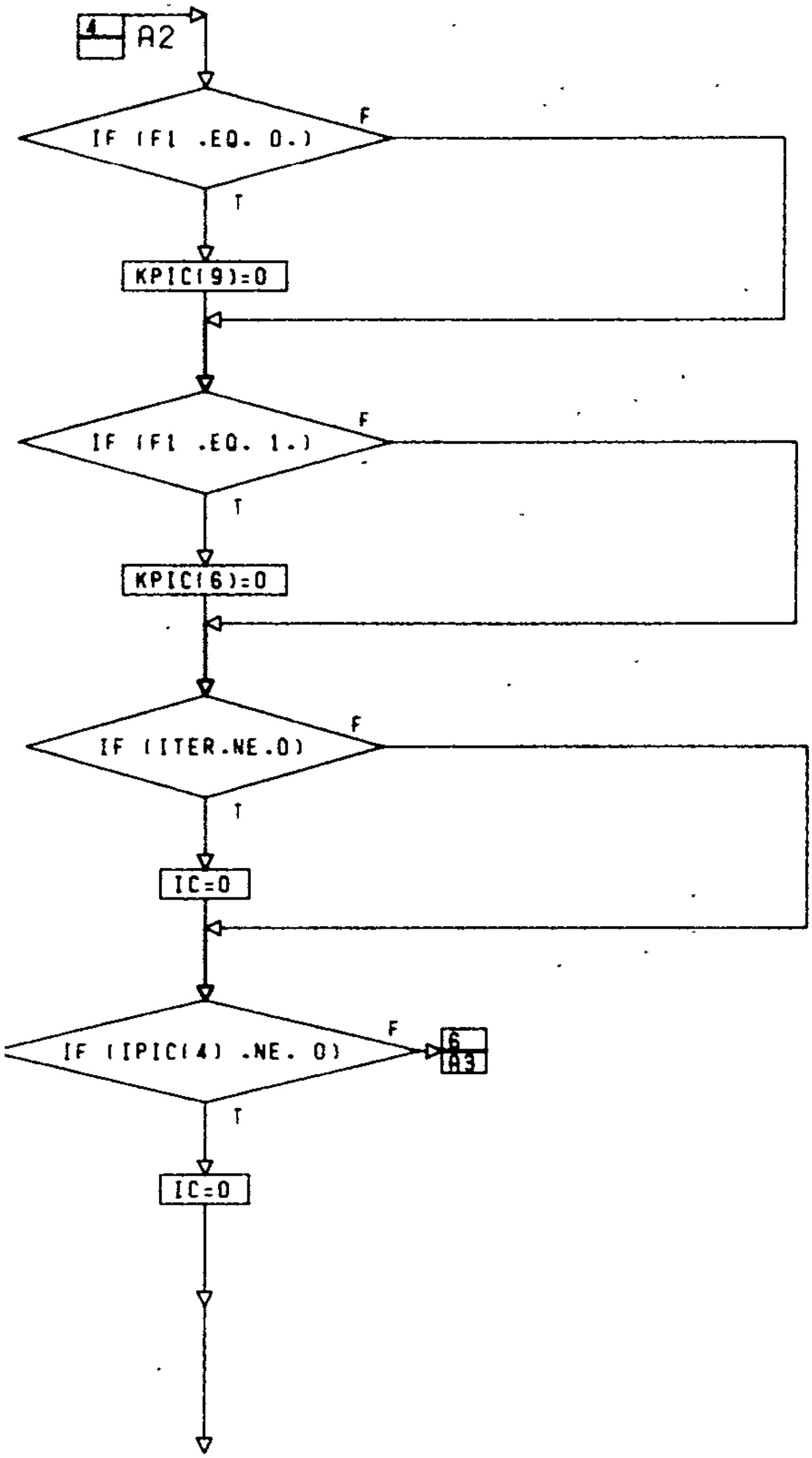

DO 1 I=1,2
1
BITRAT(I) = .001 * BITRAT(I)
SSS=0
IF (NCONF(I).EQ.1)
F
T
SSS = 1
INX=1
IF (NCONF.EQ.4.OR.NCONF.EQ.5)
F
T
INX=2
C INITIALIZATION OF IPIC AND ICHOSE
ICC=IC+1
IF (ITER.NE.0)
F
4
A
T
ICC=1

CONT. ON PG 4

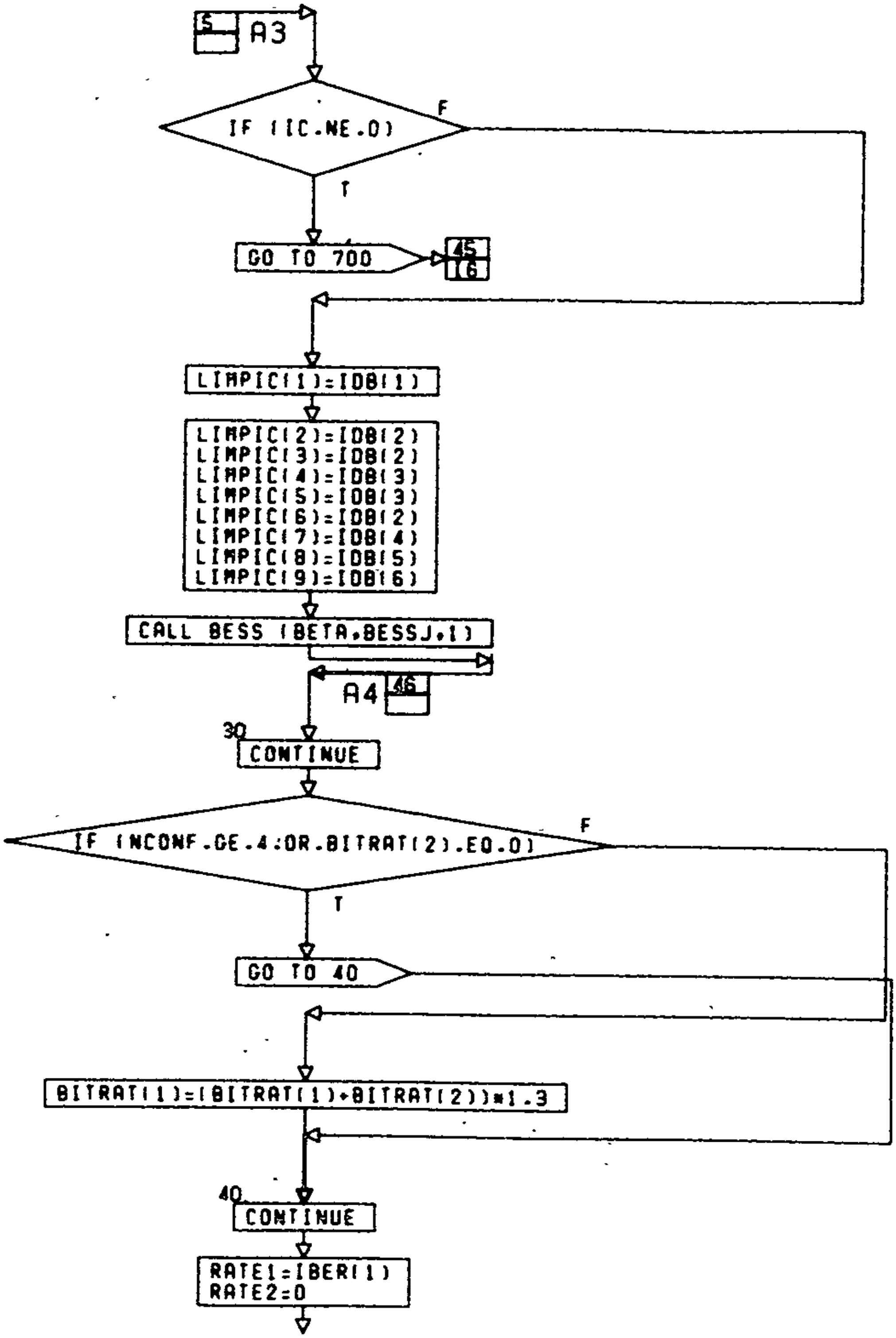


3
A1
IF (ITER.EQ.0 .AND. IPIC(4).GT.0)
F
T
ICC=1
DO 10 I=ICC,9
10
KCHOSE(I)=0
DO 20 I=1,9
KPIC(I)=IPIC(I)
20
IF (ITER.EQ.0.AND.IPIC(I).EQ.0)
F
T
ENTER AF
KPIC(I)=RESET(I)
F1=0.
IF (NCONF .EQ. 2 .OR. NCONF .EQ. 4)
F
5
A2
T
F1=1.

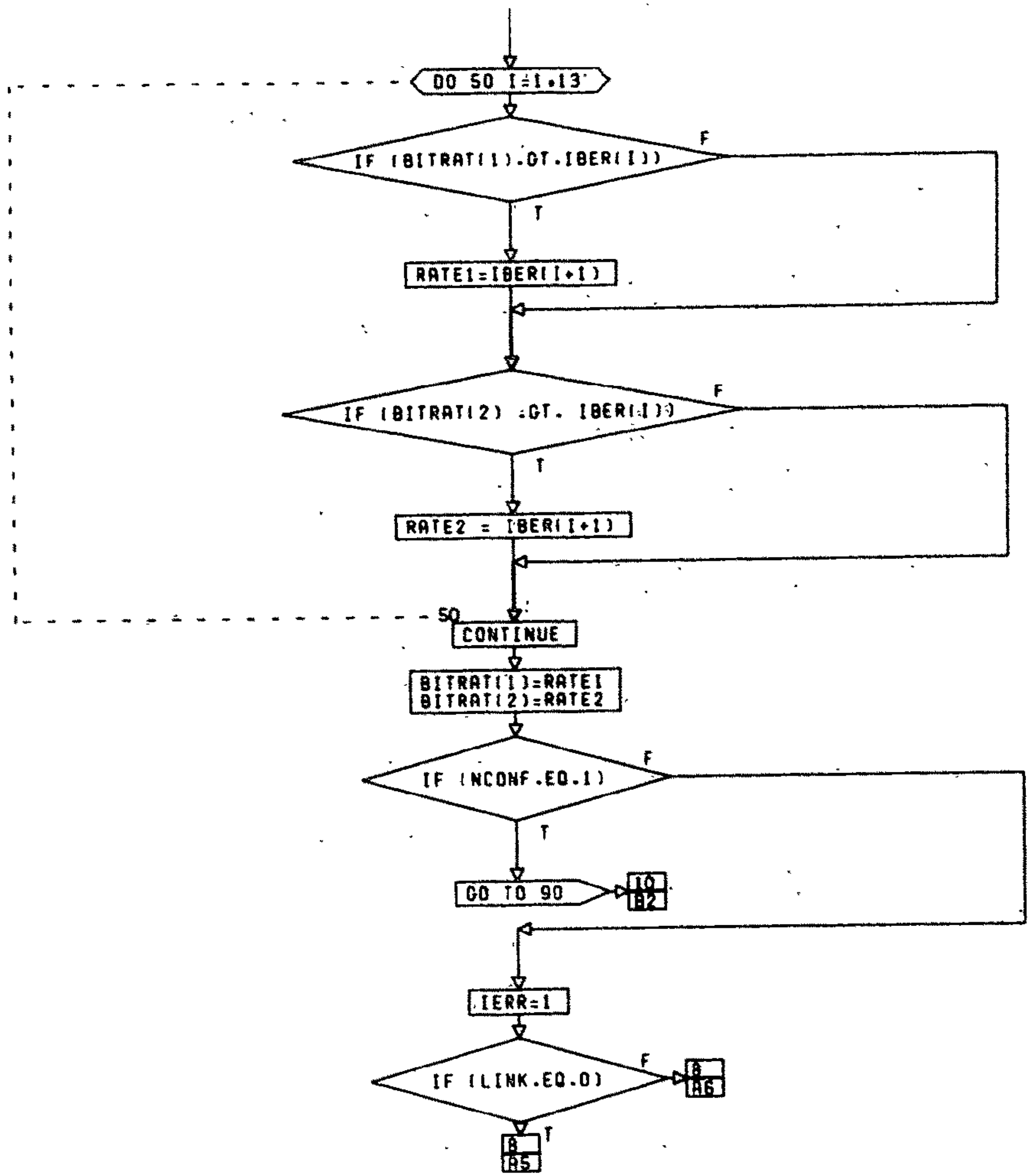
CONT. ON PG 5


4
A2
IF (FI .EQ. 0.)
F
T
KPIC(9)=0
IF (FI .EQ. 1.)
F
T
KPIC(6)=0
IF (ITER.NE.0)
F
T
IC=0
IF (IPIC(4) .NE. 0)
F
6
A3
T
IC=0

CONT. ON PG 6

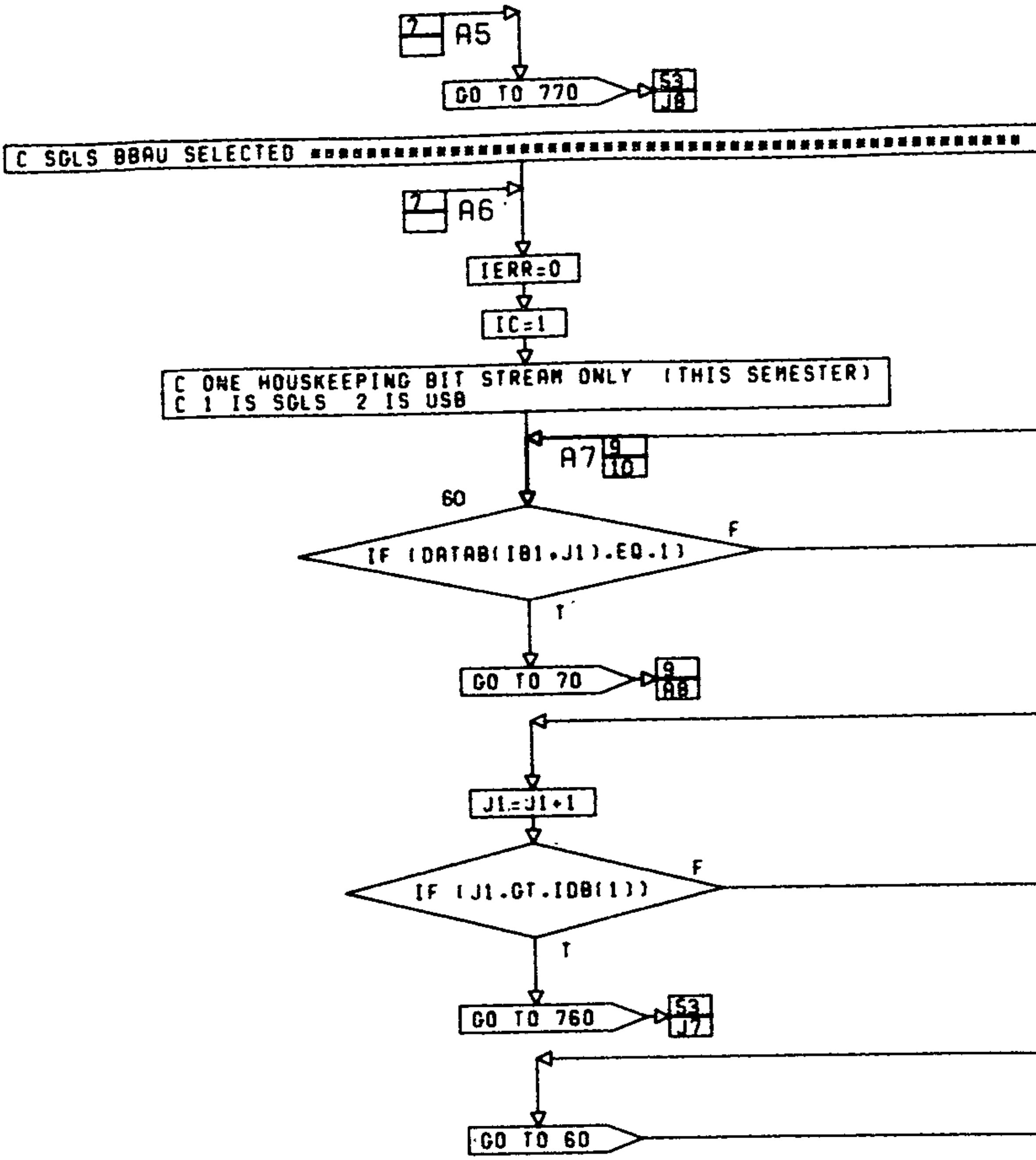

5
A3
IF (IC.NE.0)
F
T
GO TO 700
45
16
LIMPIC(1)=IDB(1)
LIMPIC(2)=IDB(2)
LIMPIC(3)=IDB(2)
LIMPIC(4)=IDB(3)
LIMPIC(5)=IDB(3)
LIMPIC(6)=IDB(2)
LIMPIC(7)=IDB(4)
LIMPIC(8)=IDB(5)
LIMPIC(9)=IDB(6)
CALL BESS (BETA,BESSJ,1)
A4
46
30
CONTINUE
IF (NCONF.GE.4.OR.BITRAT(2).EQ.0)
F
T
GO TO 40
BITRAT(1)=(BITRAT(1)+BITRAT(2))*1.3
40
CONTINUE
RATE1=IBER(1)
RATE2=0

CONT. ON PG 7

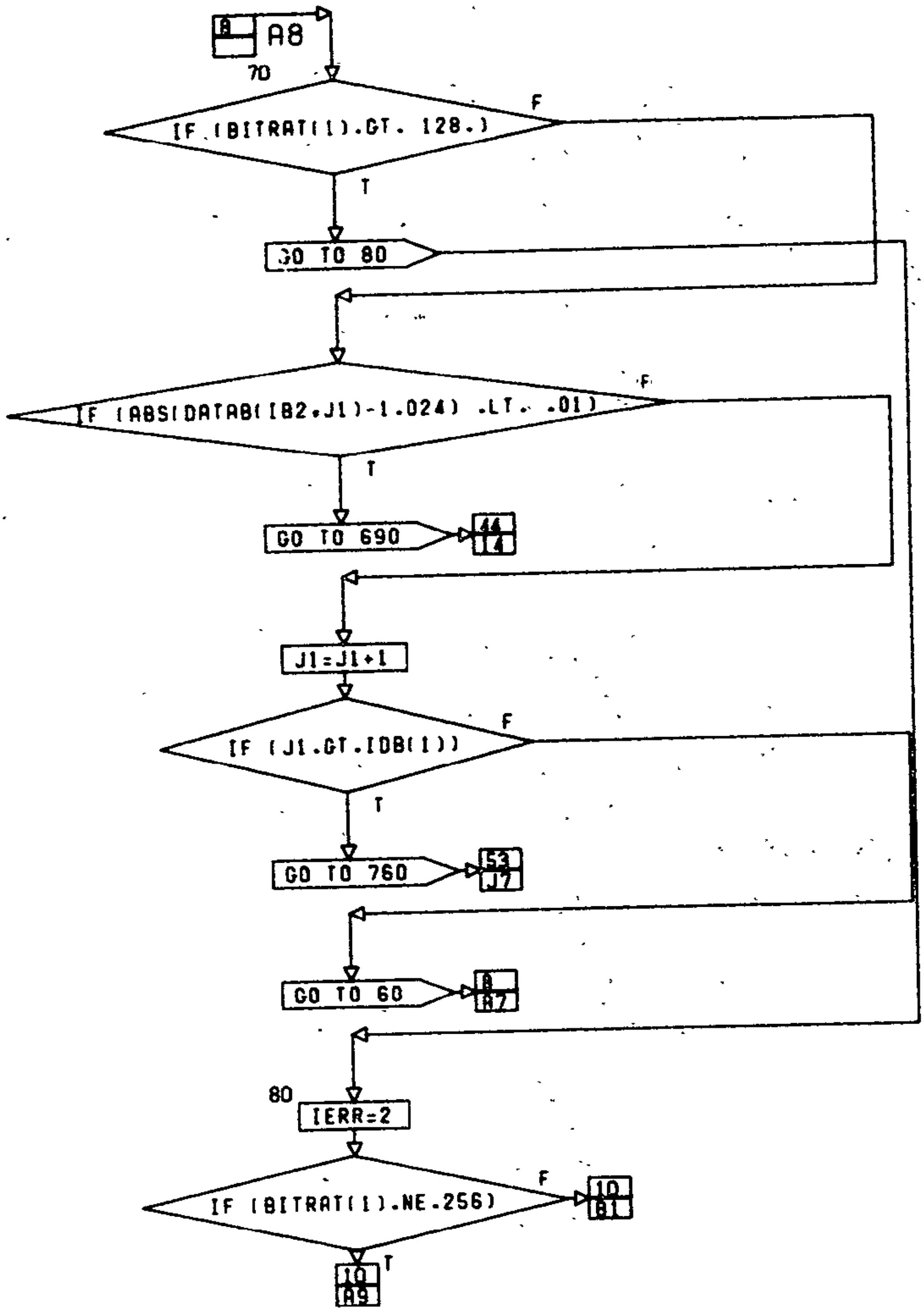


DO 50 I=1,13
IF (BITRAT(1).GT.IBER(I))
F
T
RATE1=IBER(I+1)
IF (BITRAT(2) .GT. IBER(I))
F
T
RATE2 = IBER(I+1)
50
CONTINUE
BITRAT(1)=RATE1
BITRAT(2)=RATE2
IF (NCONF.EQ.1)
F
T
GO TO 90
10
B2
IERR=1
IF (LINK.EQ.0)
F
8
A6
T
8
A5

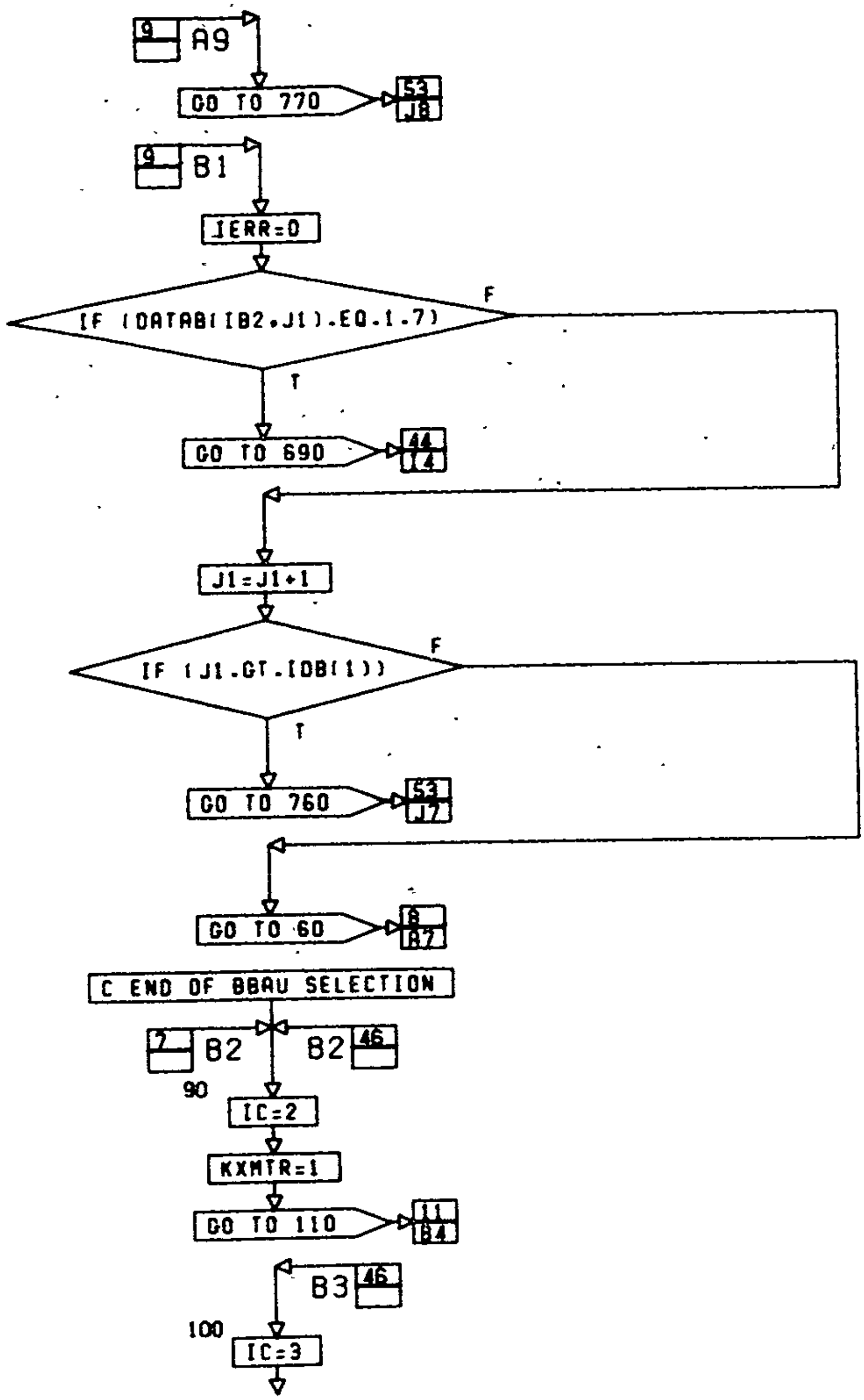
CONT. ON PG 8


A5
GO TO 770
53
J8
C SGLS BBAU SELECTED
A6
IERR=0
IC=1
C ONE HOUSKEEPING BIT STREAM ONLY (THIS SEMESTER)
C 1 IS SGLS 2 IS USB
A7
9
10
60
IF (DATAB(IB1,J1).EQ.1)
F
T
GO TO 70
9
A8
J1=J1+1
IF (J1.GT.IDB(1))
F
T
GO TO 760
53
J7
GO TO 60

CONT. ON PG 9

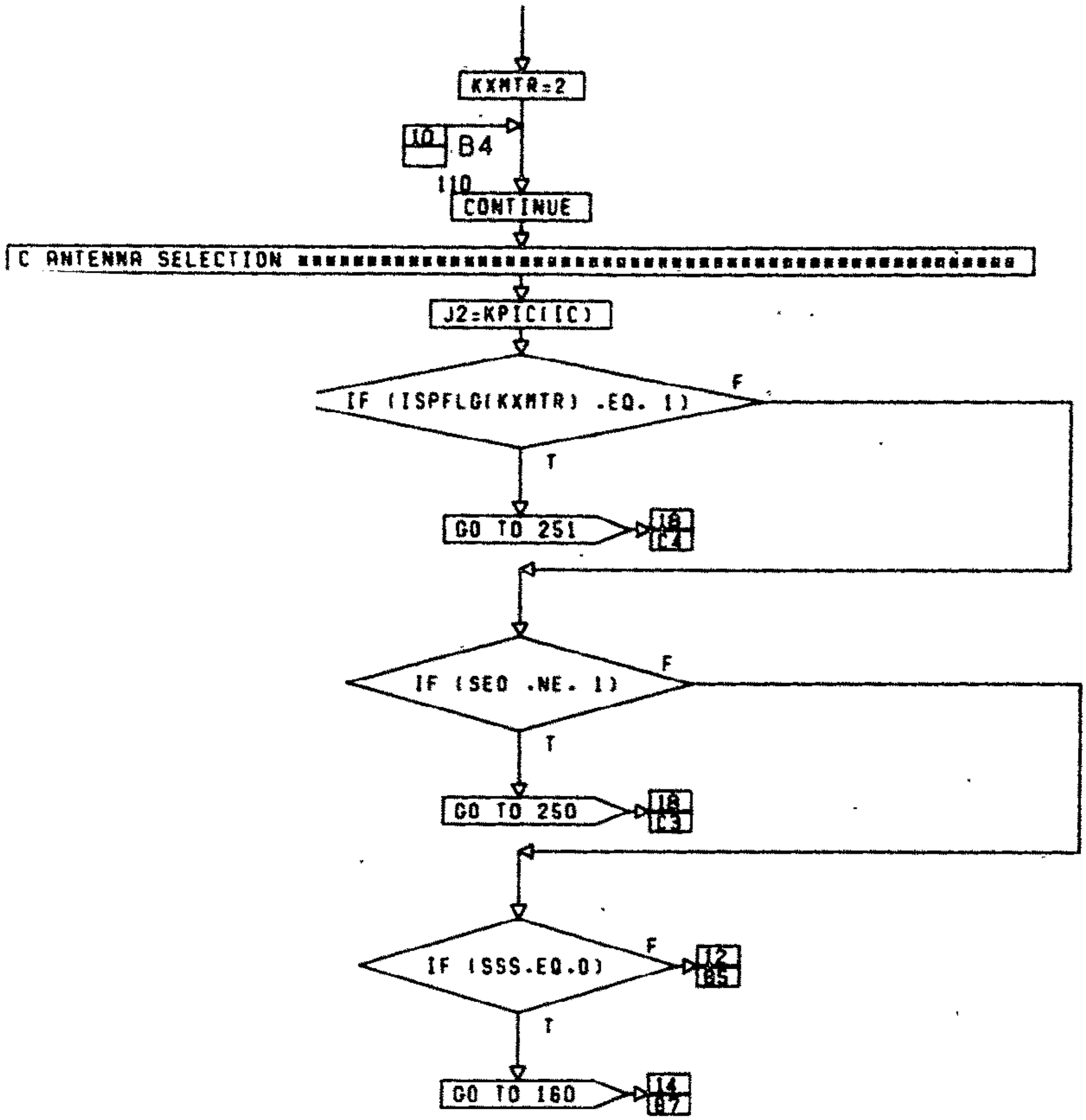

A8
70
IF (BITRAT(1).GT. 128.)
GO TO 80
IF (ABS(DATAB(IB2,J1)-1.024) .LT. .01)
GO TO 690
J1=J1+1
IF (J1.GT.IDB(1))
GO TO 760
GO TO 60
80
IERR=2
IF (BITRAT(1).NE.256)

CONT. ON PG 10

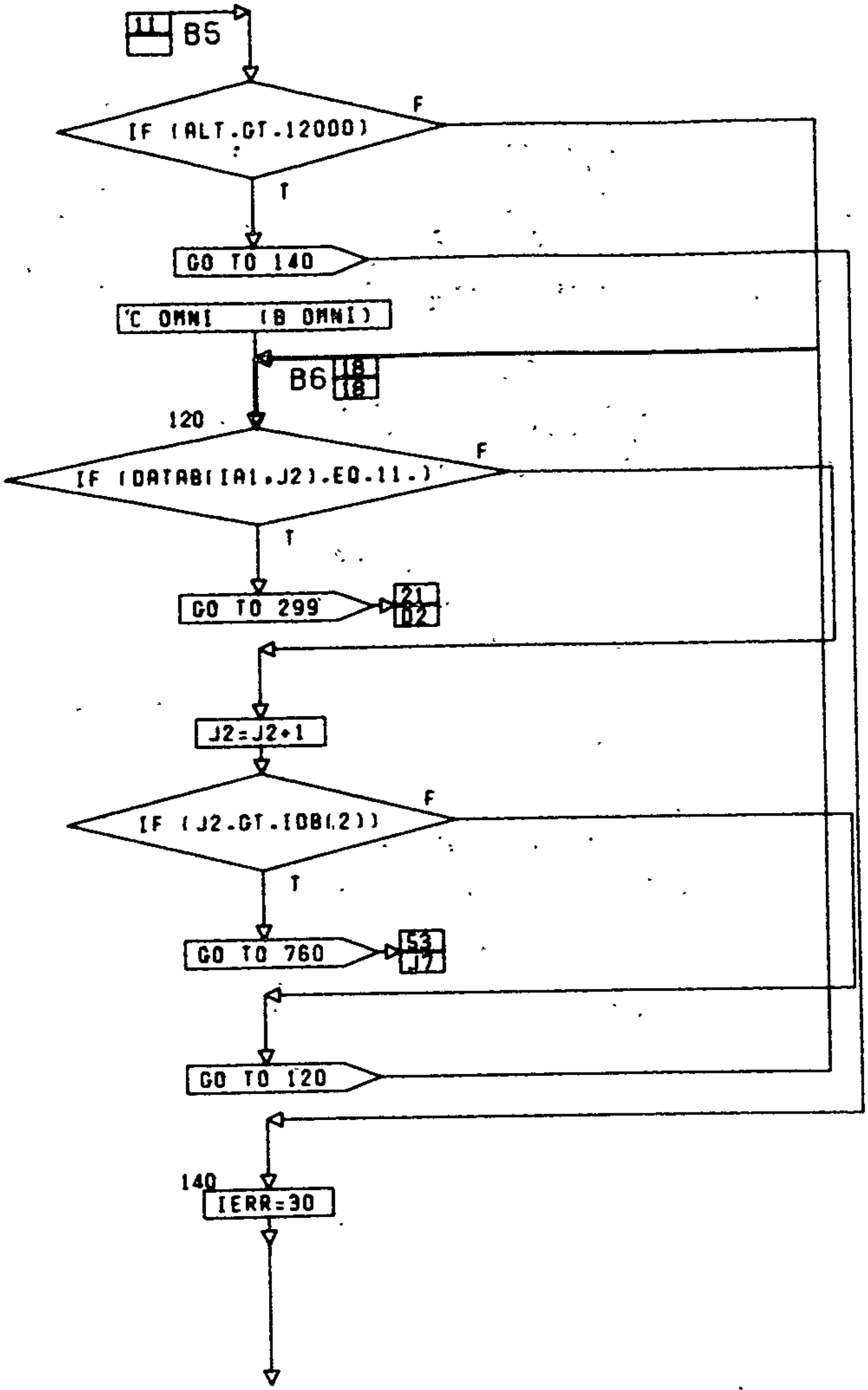


9
A9
GO TO 770
53
J8
9
B1
IERR=0
IF (DATAB(IB2,J1).EQ.1.7)
F
T
GO TO 690
44
I4
J1=J1+1
IF (J1.GT.IDB(1))
F
T
GO TO 760
53
J7
GO TO 60
6
A7
C END OF BBAU SELECTION
7
B2
B2
46
90
IC=2
KXMTR=1
GO TO 110
11
B4
B3
46
100
IC=3

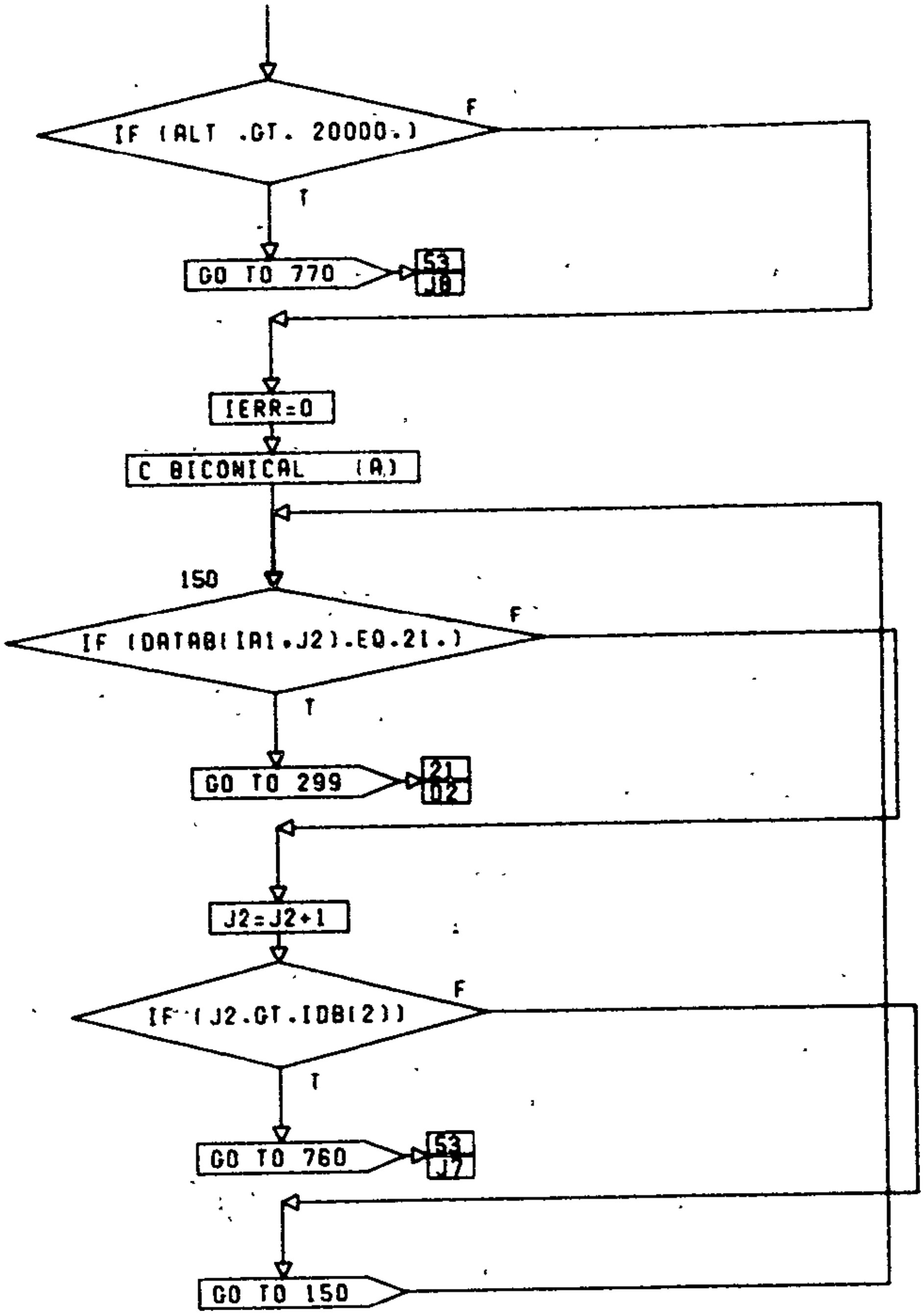
CONT. ON PG 11


KXMTR=2
10
B4
110
CONTINUE
C ANTENNA SELECTION
J2=KPIC(IC)
IF (ISPFLG(KXMTR) .EQ. 1)
F
T
GO TO 251
18
C4
IF (SEO .NE. 1)
F
T
GO TO 250
18
C3
IF (SSS.EQ.0)
F
12
B5
T
GO TO 160
14
B7

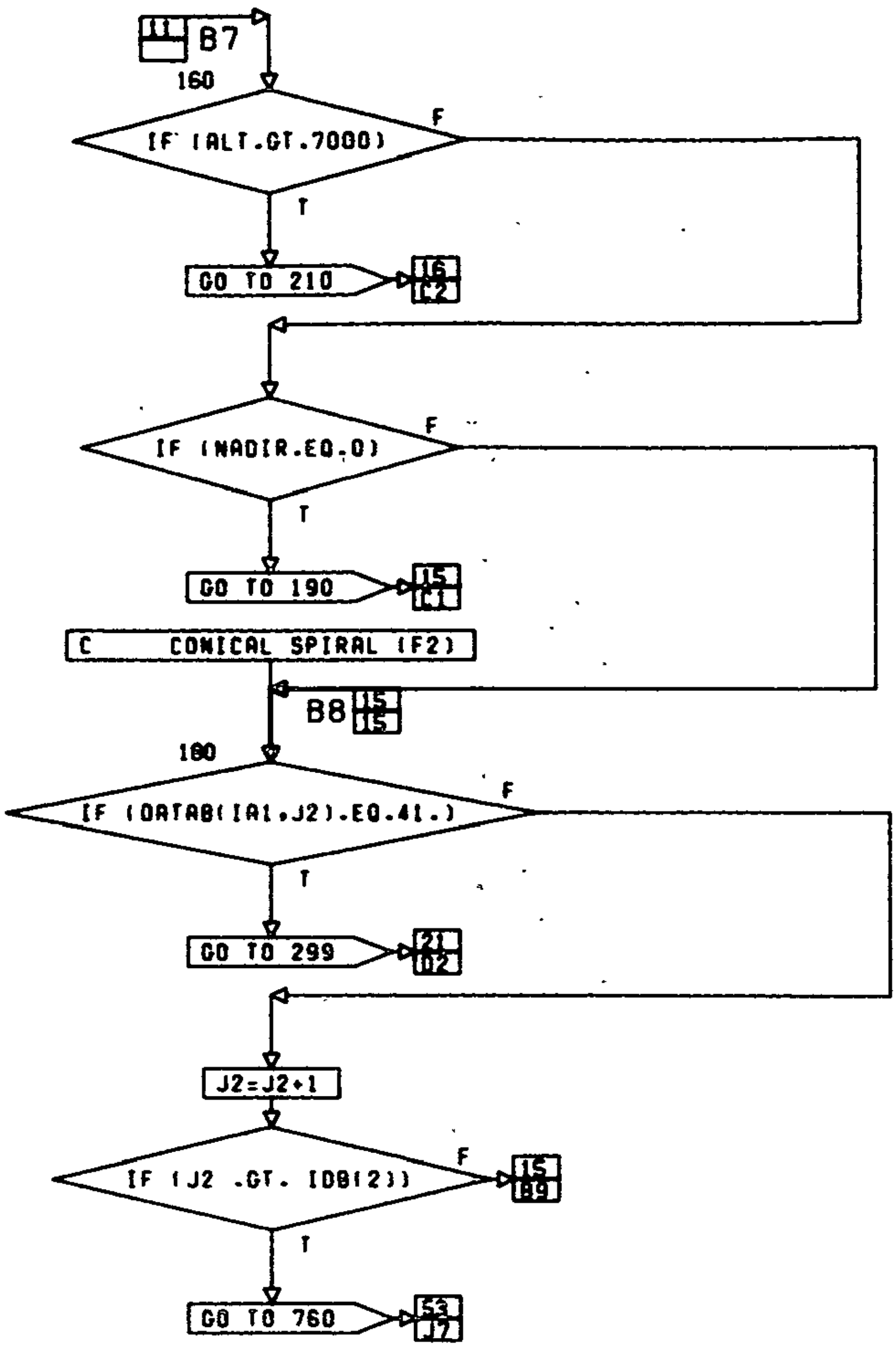
CONT. ON PG 12


11
B5
IF (ALT.GT.12000)
F
T
GO TO 140
C OMNI (B OMNI)
B6
18
18
120
IF (DATAB(IA1,J2).EQ.11.)
F
T
GO TO 299
21
D2
J2=J2+1
IF (J2.GT.IDB(2))
F
T
GO TO 760
53
J7
GO TO 120
140
IERR=30

CONT. ON PG 13

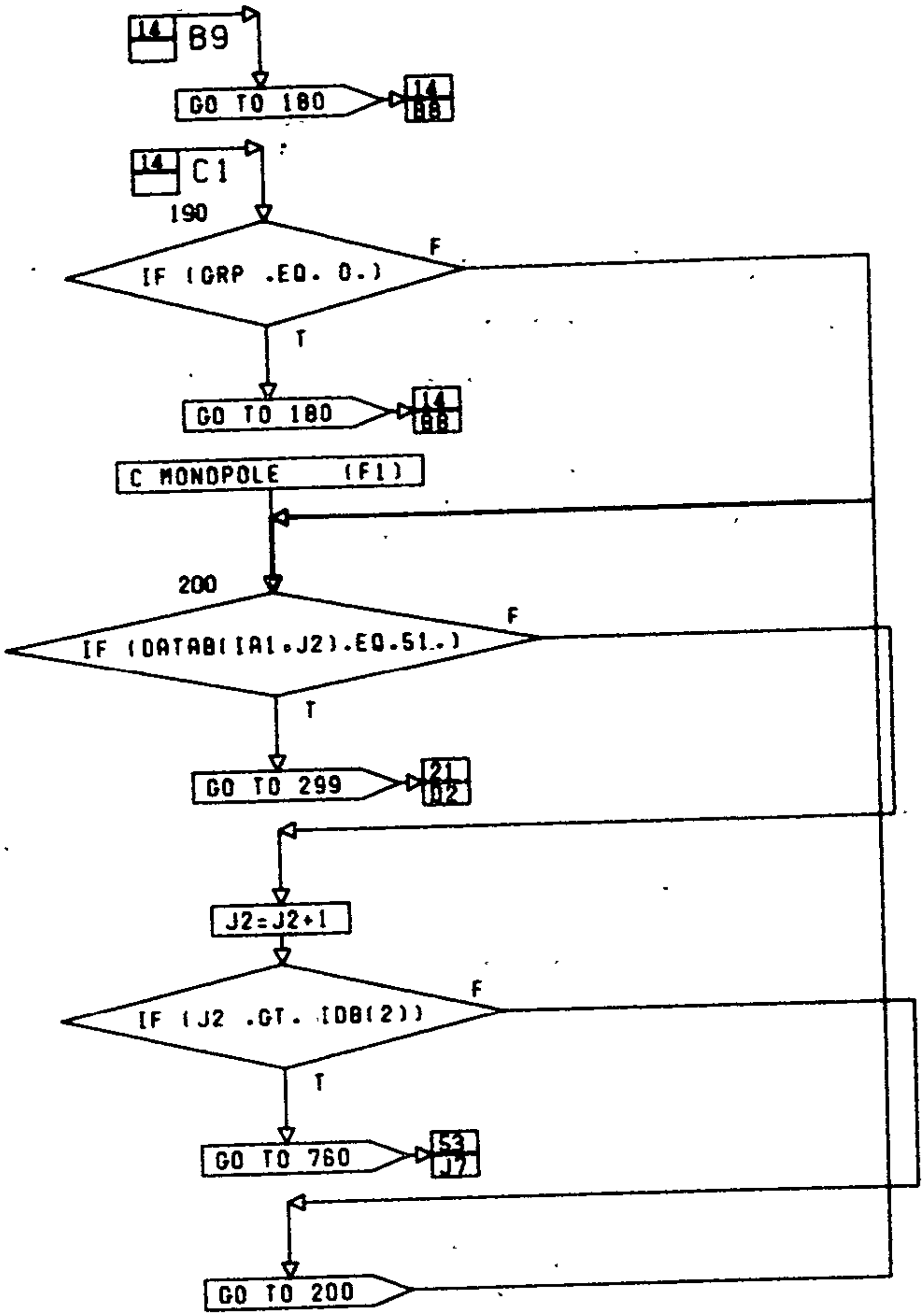

IF (ALT .GT. 20000.)
F
T
GO TO 770
53
J8
IERR=0
C BICONICAL (A)
150
IF (DATAB(IA1,J2).EQ.21.)
F
T
GO TO 299
21
D2
J2=J2+1
IF (J2.GT.IDB(2))
F
T
GO TO 760
53
J7
GO TO 150

CONT. ON PG 14



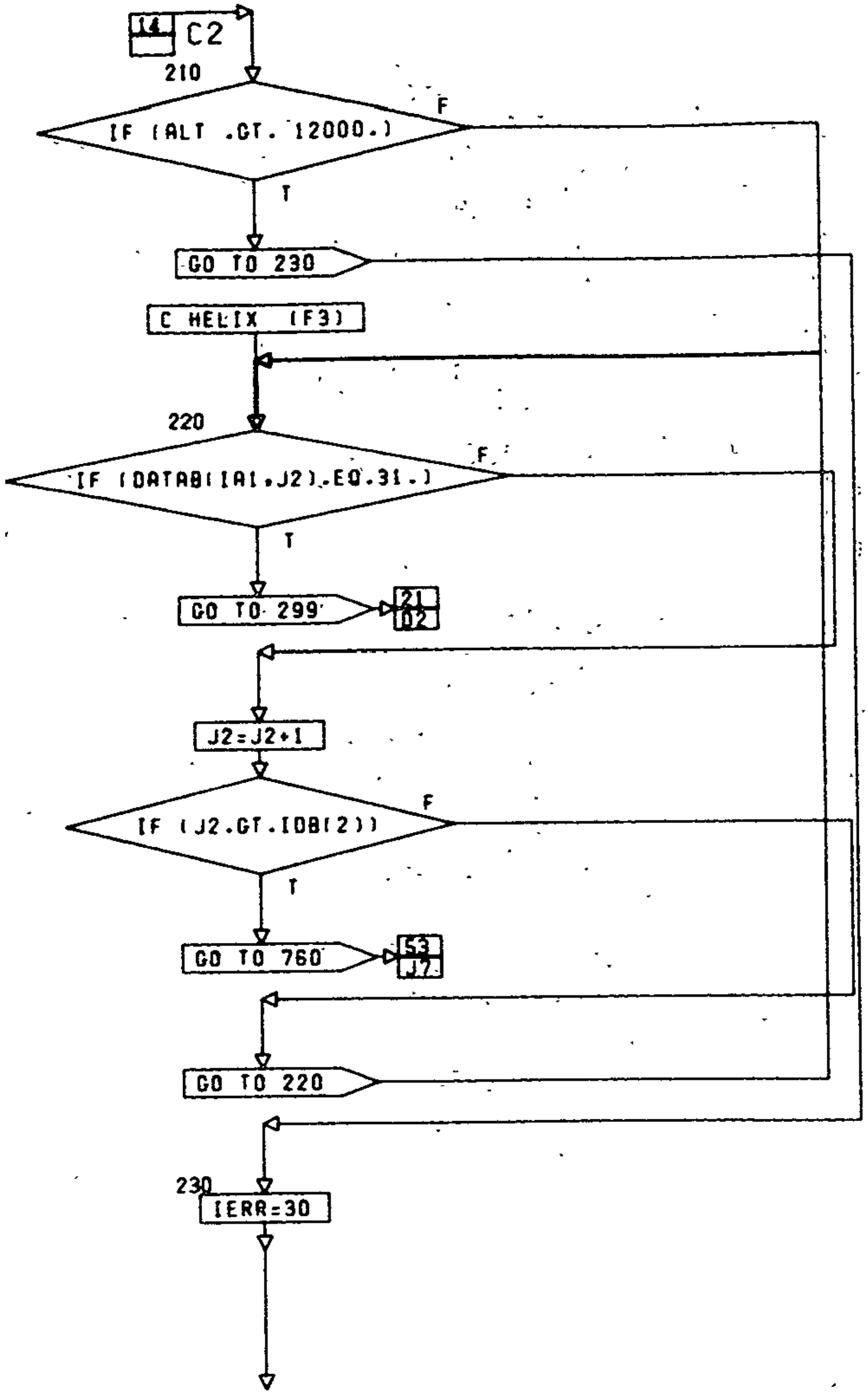
11
B7
160
IF (ALT.GT.7000)
F
T
GO TO 210
16
C2
IF (NADIR.EQ.0)
F
T
GO TO 190
15
C1
C CONICAL SPIRAL (F2)
B8
15
15
180
IF (DATAB(IA1,J2).EQ.4I.)
F
T
GO TO 299
21
D2
J2=J2+1
IF (J2 .GT. IDB(2))
F
15
B9
T
GO TO 760
53
J7

CONT. ON PG 15

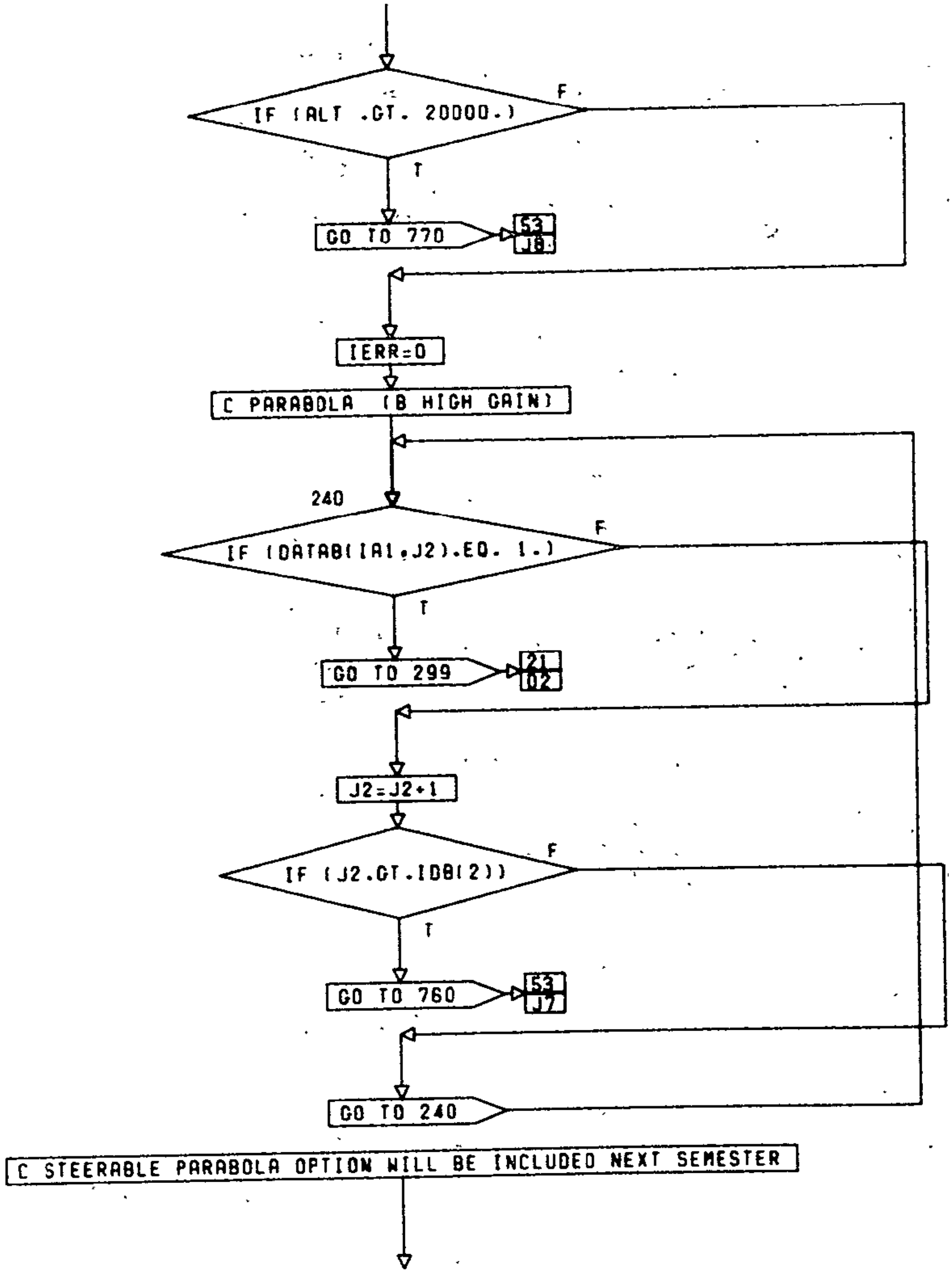


14 B9
GO TO 180
14 B8
14 C1
190
IF (GRP .EQ. 0.)
F
T
GO TO 180
14 B8
C MONOPOLE (F1)
200
IF (DATAB(IA1,J2).EQ.51.)
F
T
GO TO 299
21 D2
J2=J2+1
IF (J2 .GT. IDB(2))
F
T
GO TO 760
53 J7
GO TO 200

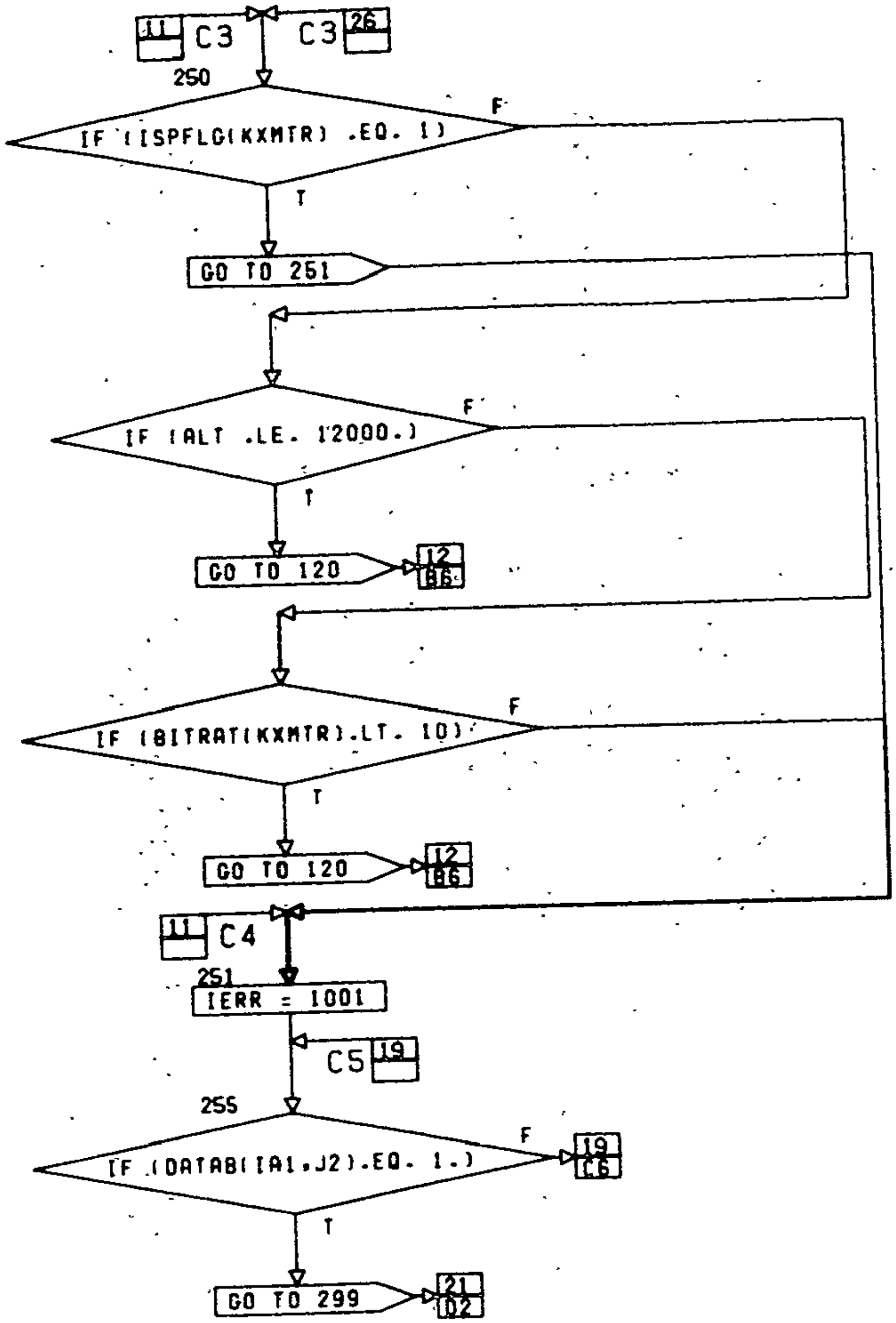
CONT. ON PG 16


14
C2
210
IF (ALT .GT. 12000.)
F
T
GO TO 230
C HELIX (F3)
220
IF (DATAB(IA1,J2).EQ.31.)
F
T
GO TO 299
21
D2
J2=J2+1
IF (J2.GT.IDB(2))
F
T
GO TO 760
53
J7
GO TO 220
230
IERR=30

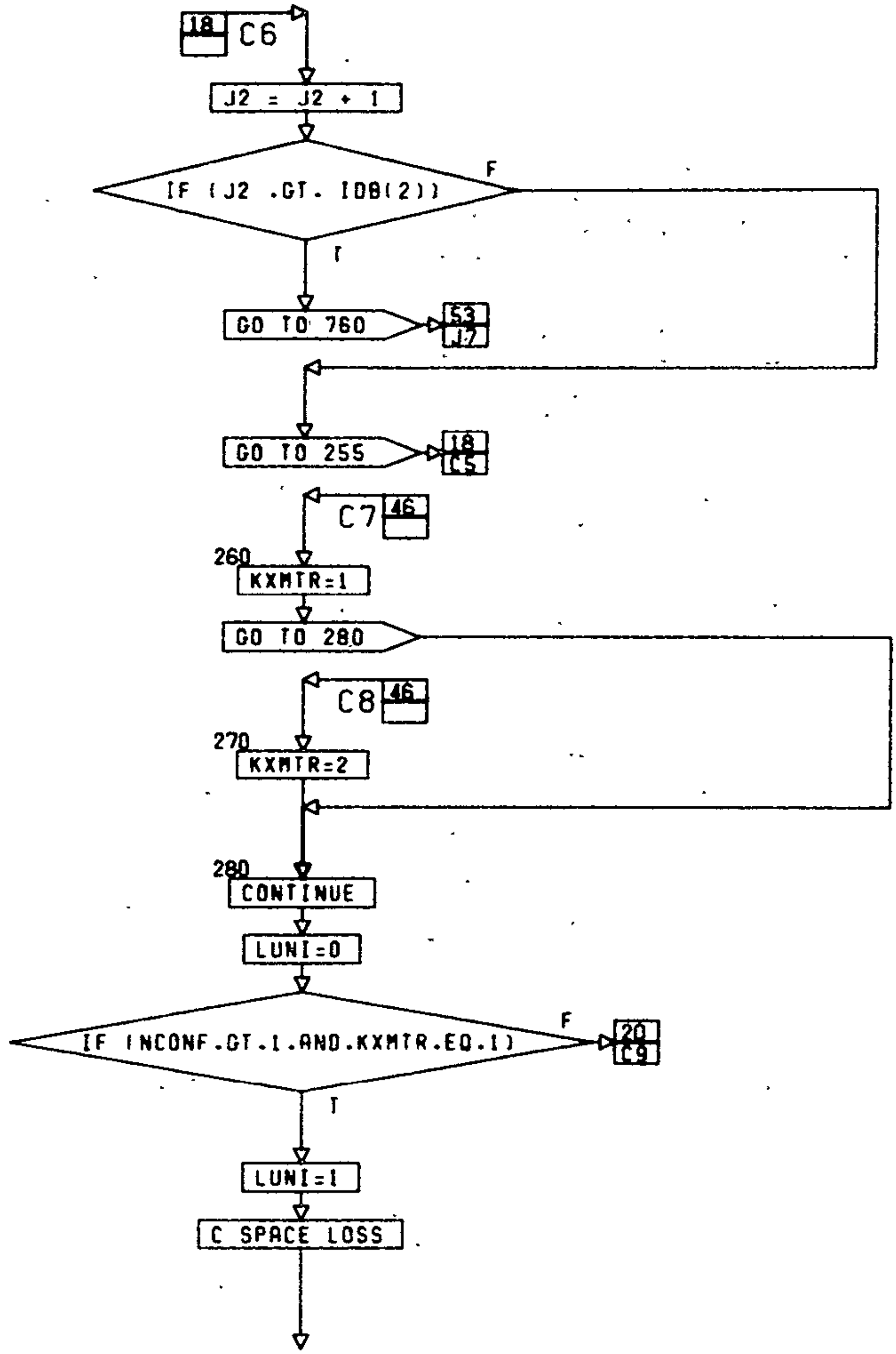
CONT. ON PG 17


IF (ALT .GT. 20000.)
F
T
GO TO 770
53
J8
IERR=0
C PARABOLA (8 HIGH GAIN)
240
IF (DATAB(IA1,J2).EQ. 1.)
F
T
GO TO 299
21
D2
J2=J2+1
IF (J2.GT.IDB(2))
F
T
GO TO 760
53
J7
GO TO 240
C STEERABLE PARABOLA OPTION WILL BE INCLUDED NEXT SEMESTER

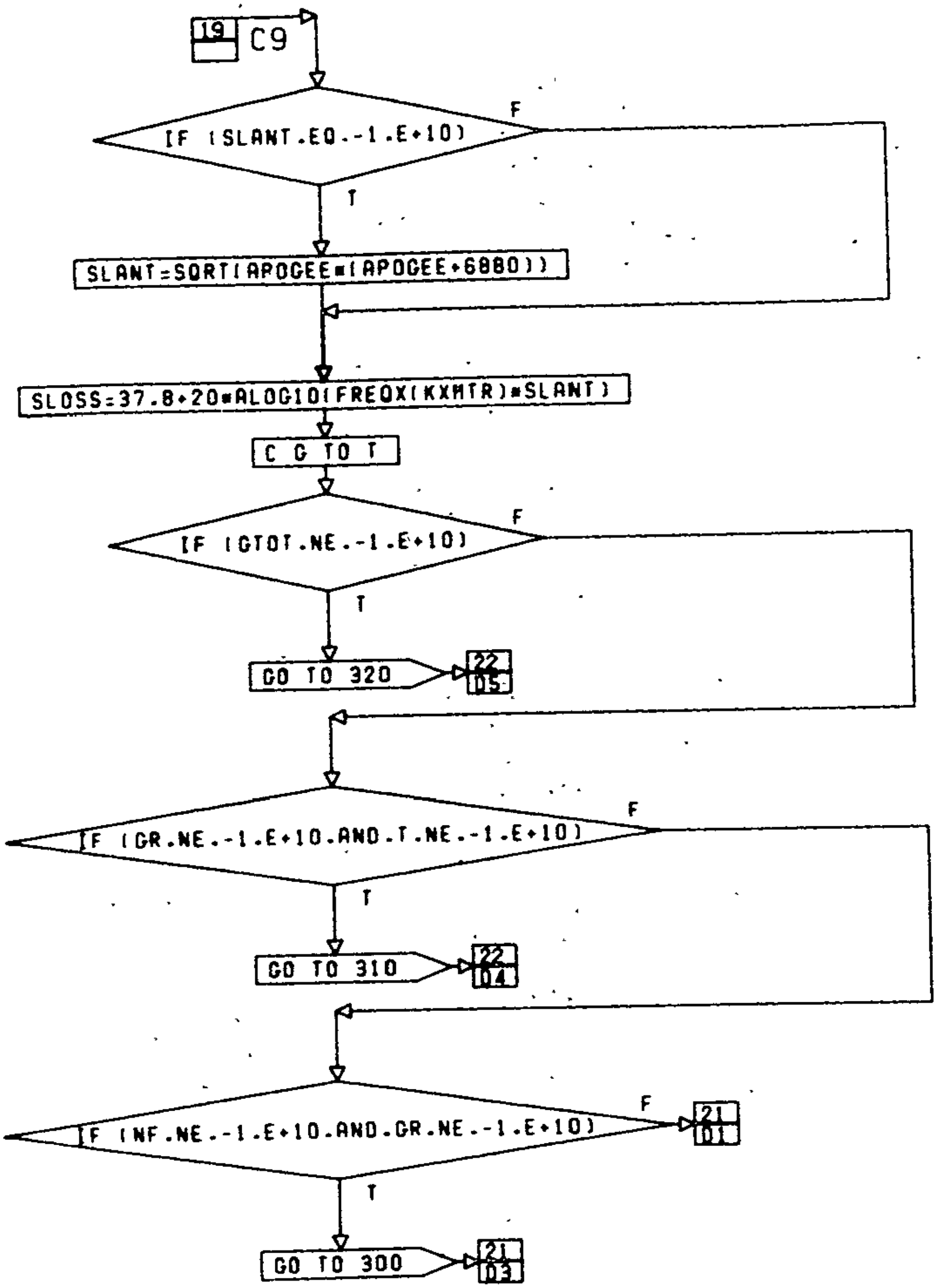
CONT. ON PG 18


11
C3
C3
26
250
IF (ISPFLG(KXMTR) .EQ. 1)
F
T
GO TO 251
IF (ALT .LE. 12000.)
F
T
GO TO 120
12
B6
IF (BITRAT(KXMTR).LT. 10)
F
T
GO TO 120
12
B6
11
C4
251
IERR = 1001
C5
19
255
IF (DATAB(IA1,J2).EQ. 1.)
F
19
C6
T
GO TO 299
21
D2

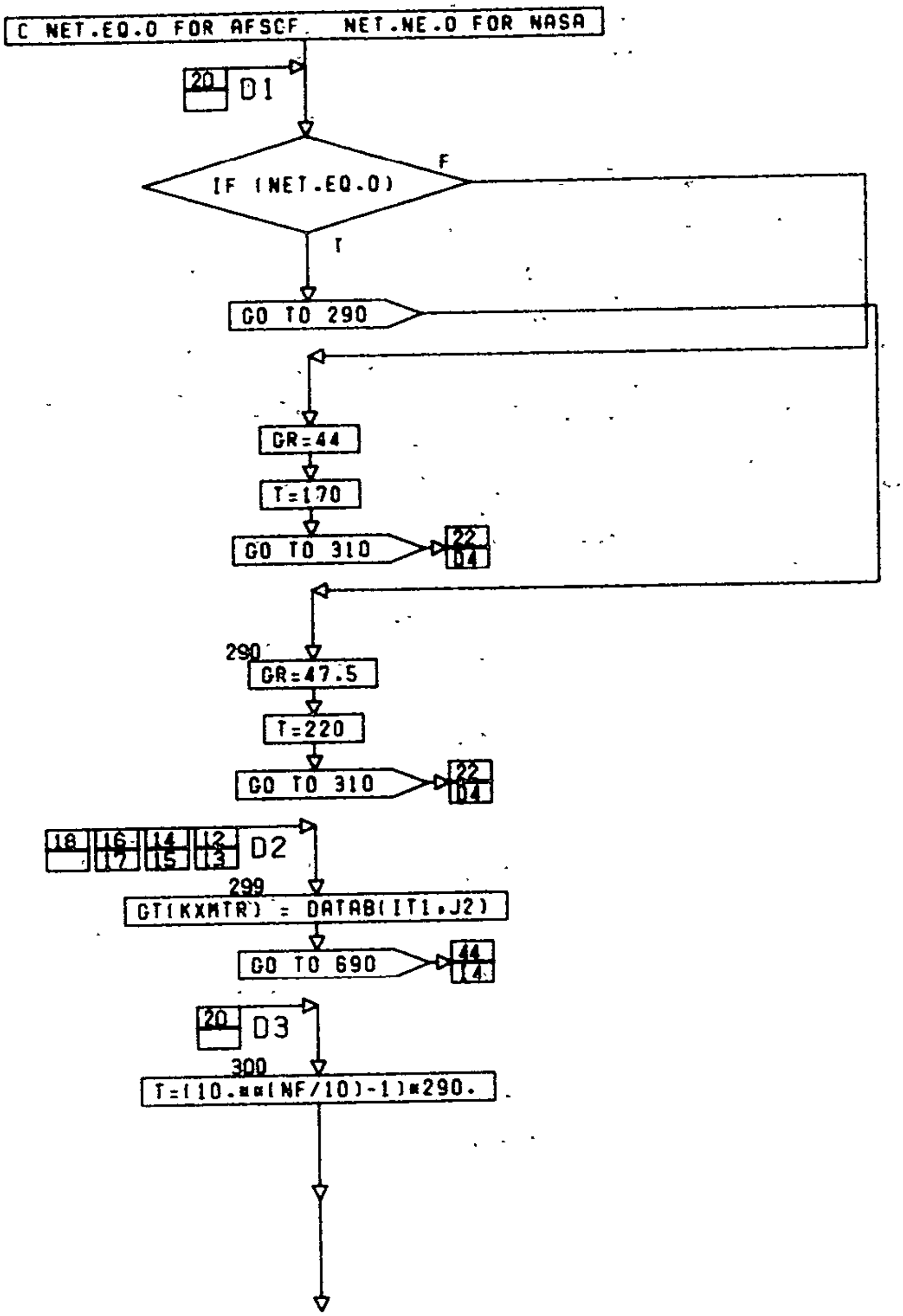
CONT. ON PG 19


18
C6
J2 = J2 + 1
IF (J2 .GT. IDB(2))
F
T
GO TO 760
53
J7
GO TO 255
18
C5
C7
46
260
KXMTR=1
GO TO 280
C8
46
270
KXMTR=2
280
CONTINUE
LUNI=0
IF (NCONF.GT.1.AND.KXMTR.EQ.1)
F
20
C9
T
LUNI=1
C SPACE LOSS

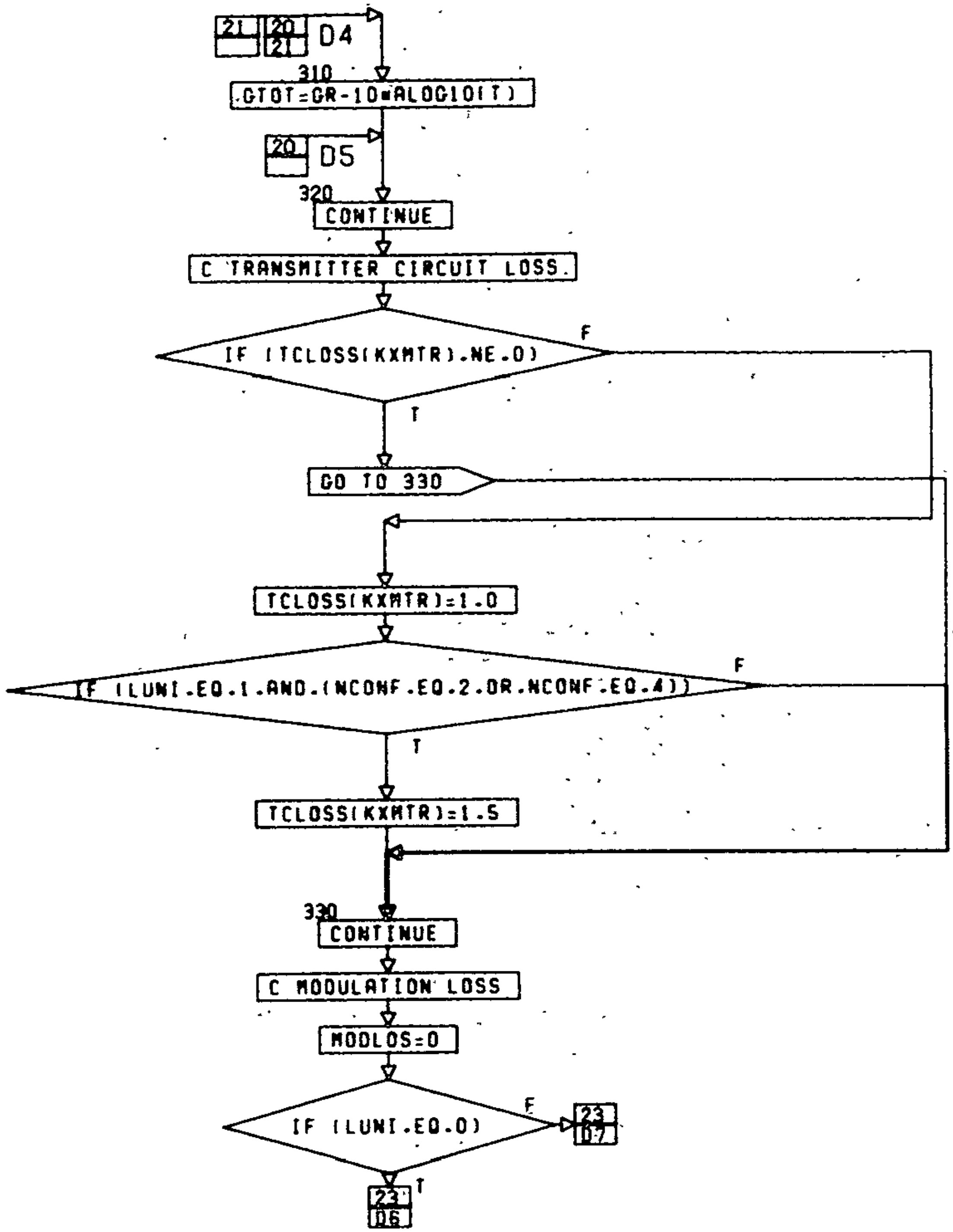
CONT. ON PG 20


19
C9
IF (SLANT.EQ.-1.E+10)
F
T
SLANT=SQRT(APOGEE*(APOGEE+6880))
SLOSS=37.8+20*ALOG10(FREQX(KXMTR)*SLANT)
C G TO T
IF (GTOT.NE.-1.E+10)
GO TO 320
22
D5
IF (GR.NE.-1.E+10.AND.T.NE.-1.E+10)
GO TO 310
22
D4
IF (NF.NE.-1.E+10.AND.GR.NE.-1.E+10)
21
D1
GO TO 300
21
D3

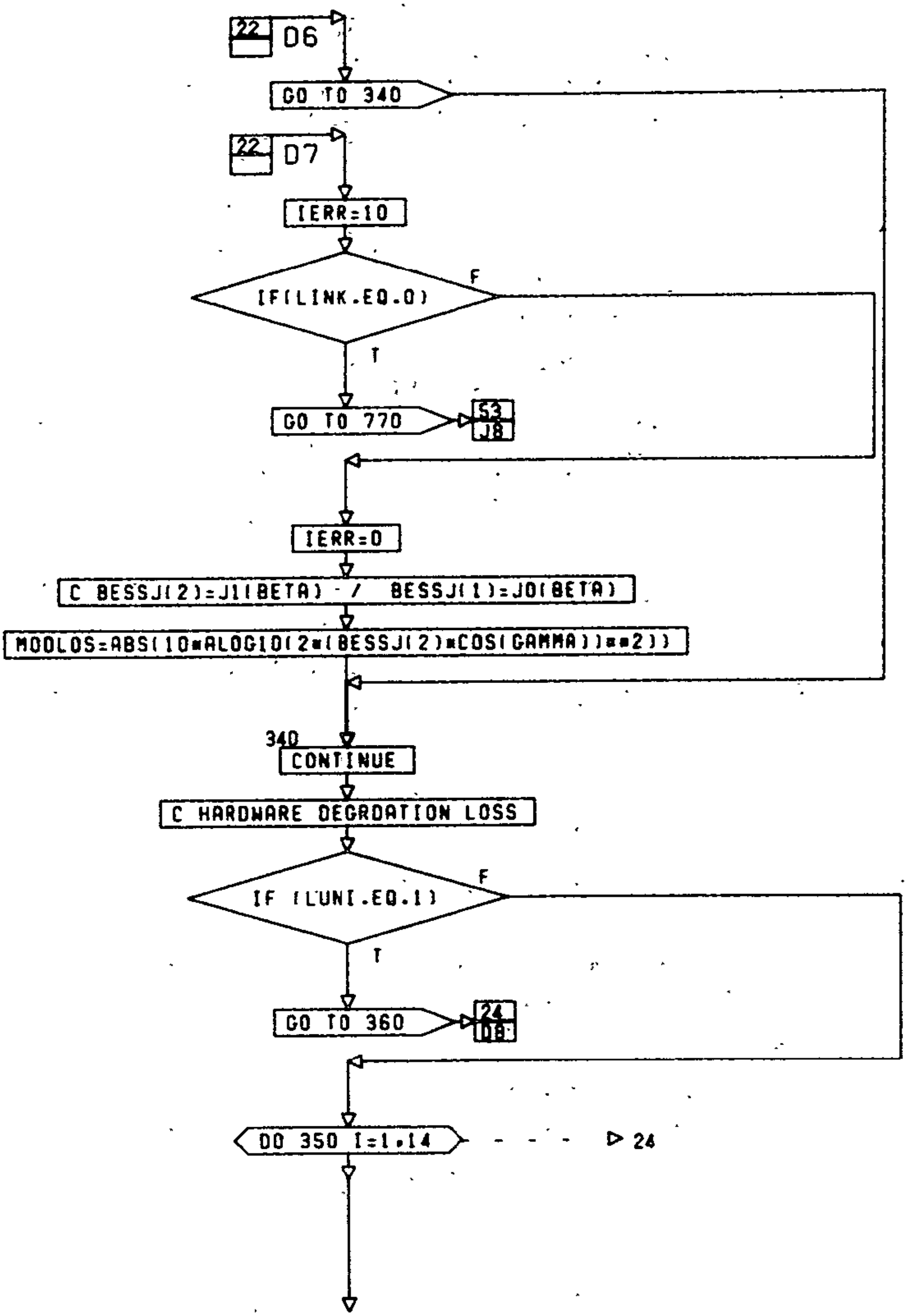
CONT. ON PG 21


C NET.EQ.0 FOR AFSCF. NET.NE.0 FOR NASA
20
D1
IF (NET.EQ.0)
F
T
GO TO 290
GR=44
T=170
GO TO 310
22
D4
290
GR=47.5
T=220
GO TO 310
22
D4
18
16
17
14
15
12
13
D2
299
GT(KXMTR) = DATAB(IT1,J2)
GO TO 690
44
14
20
D3
300
T=(10.**(NF/10)-1)*290.

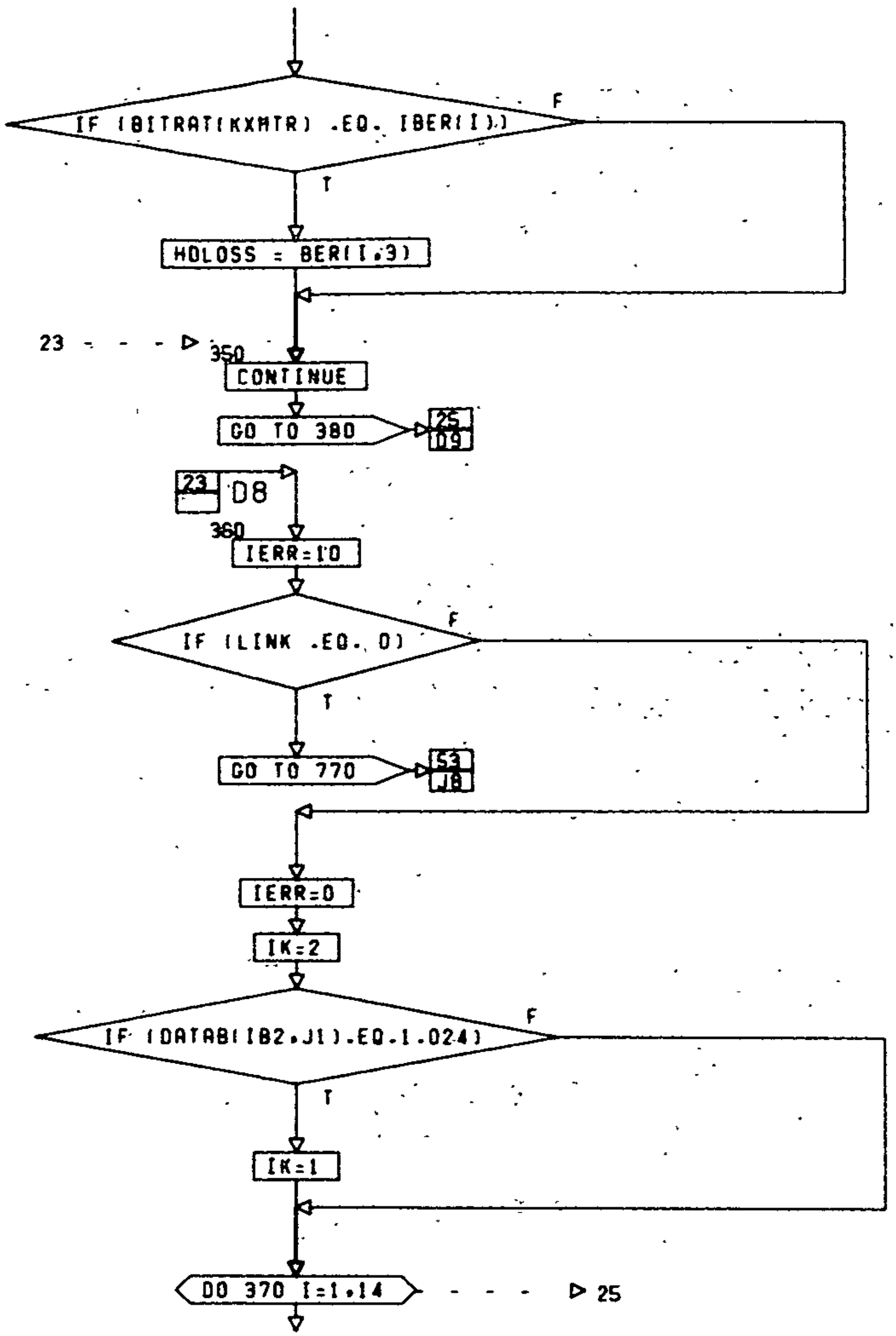
CONT. ON PG 22


21
20
21
D4
310
GTOT=GR-10*ALOG10(T)
20
D5
320
CONTINUE
C TRANSMITTER CIRCUIT LOSS.
IF (TCLOSS(KXMTR).NE.0)
F
T
GO TO 330
TCLOSS(KXMTR)=1.0
IF (LUNI.EQ.1.AND.(NCONF.EQ.2.OR.NCONF.EQ.4))
F
T
TCLOSS(KXMTR)=1.5
330
CONTINUE
C MODULATION LOSS
MODLOS=0
IF (LUNI.EQ.0)
F
23
D7
T
23
D6

CONT. ON PG 23

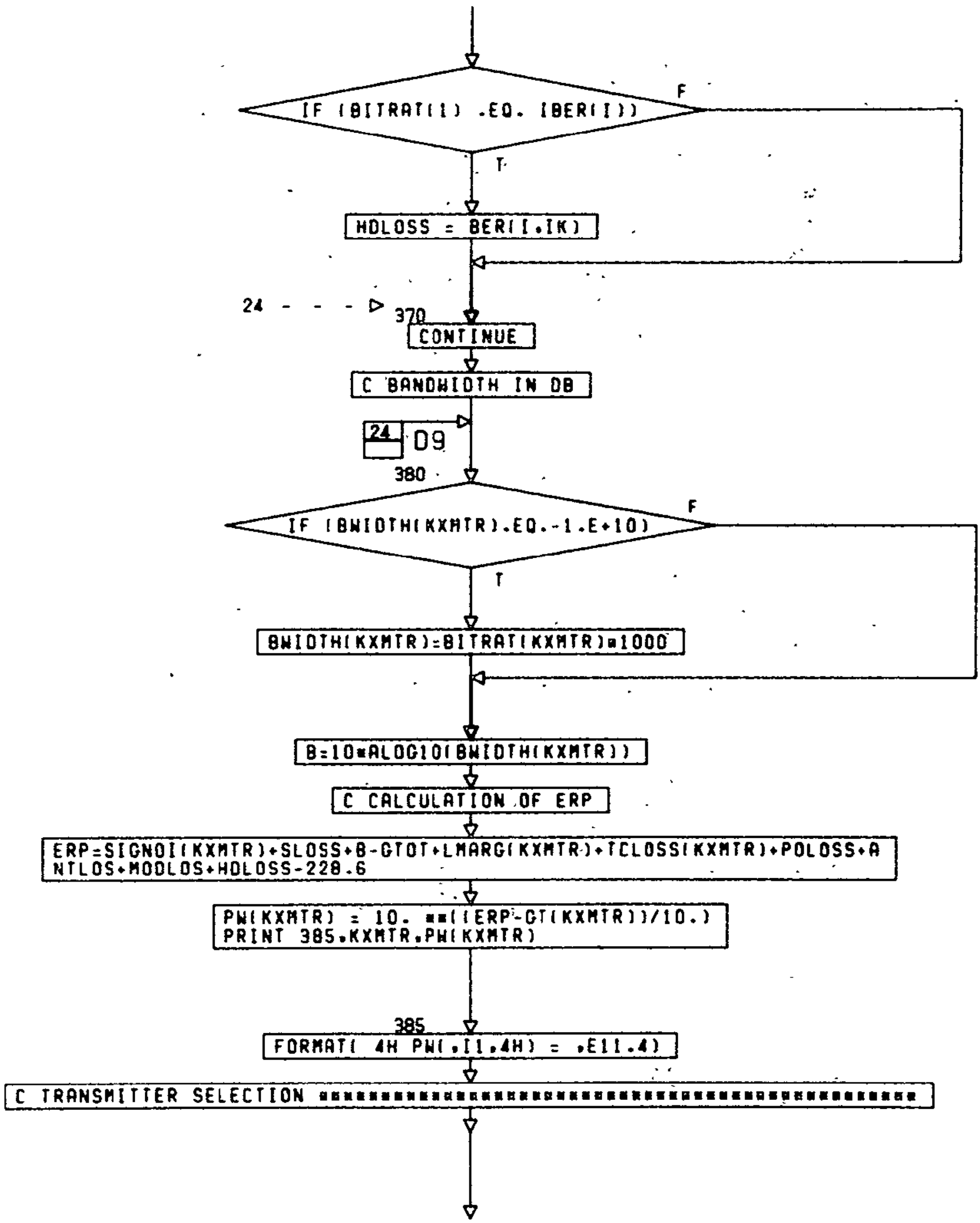

22
D6
GO TO 340
22
D7
IERR=10
IF(LINK.EQ.0)
F
T
GO TO 770
53
J8
IERR=0
C BESSJ(2)=J1(BETA) / BESSJ(1)=J0(BETA)
MODLOS=ABS(10*ALOG10(2*(BESSJ(2)*COS(GAMMA))**2))
340
CONTINUE
C HARDWARE DEGRADATION LOSS
IF (LUNI.EQ.1)
F
T
GO TO 360
24
D8
DO 350 I=1,14
24

CONT. ON PG 24

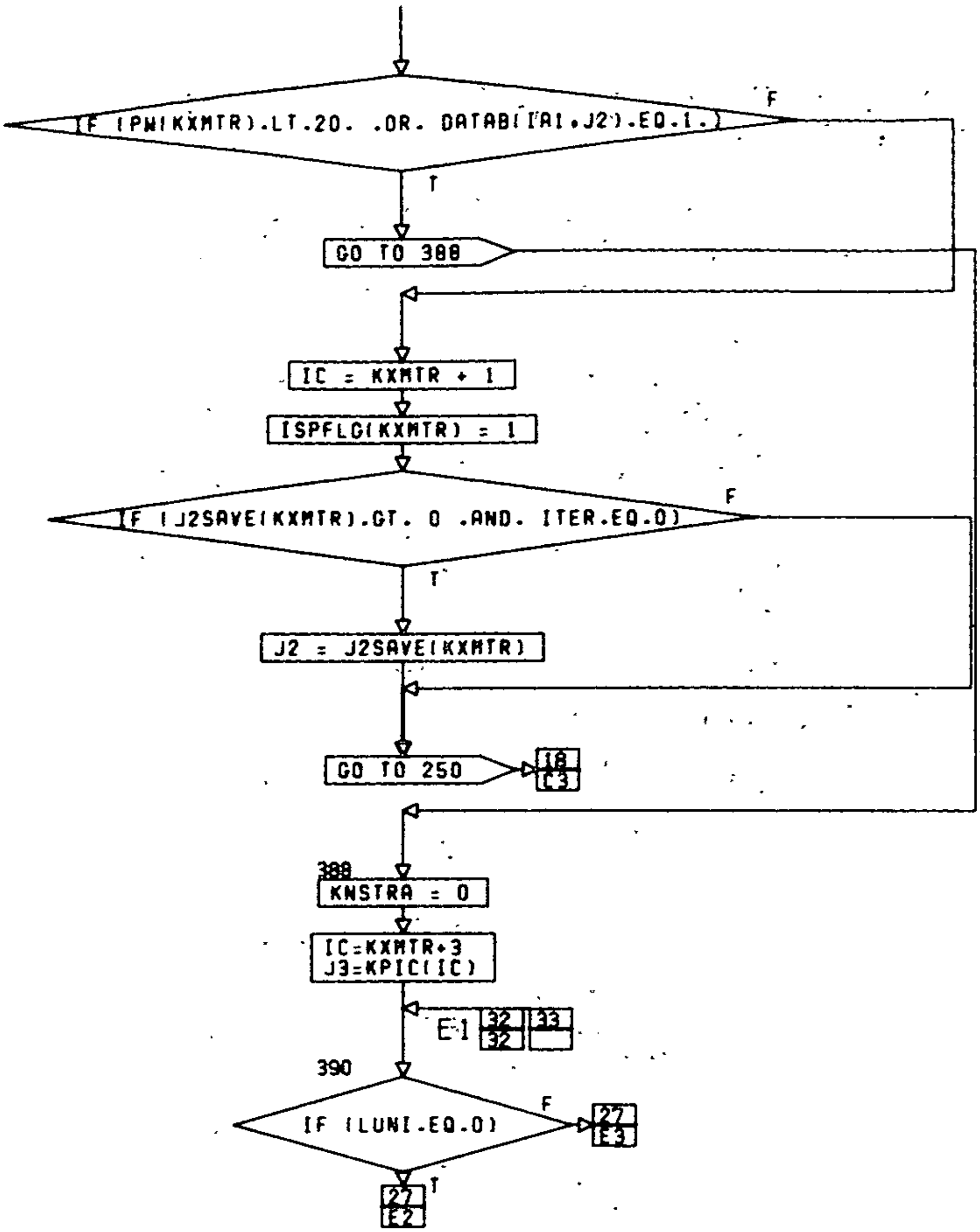


CONT. ON PG 25

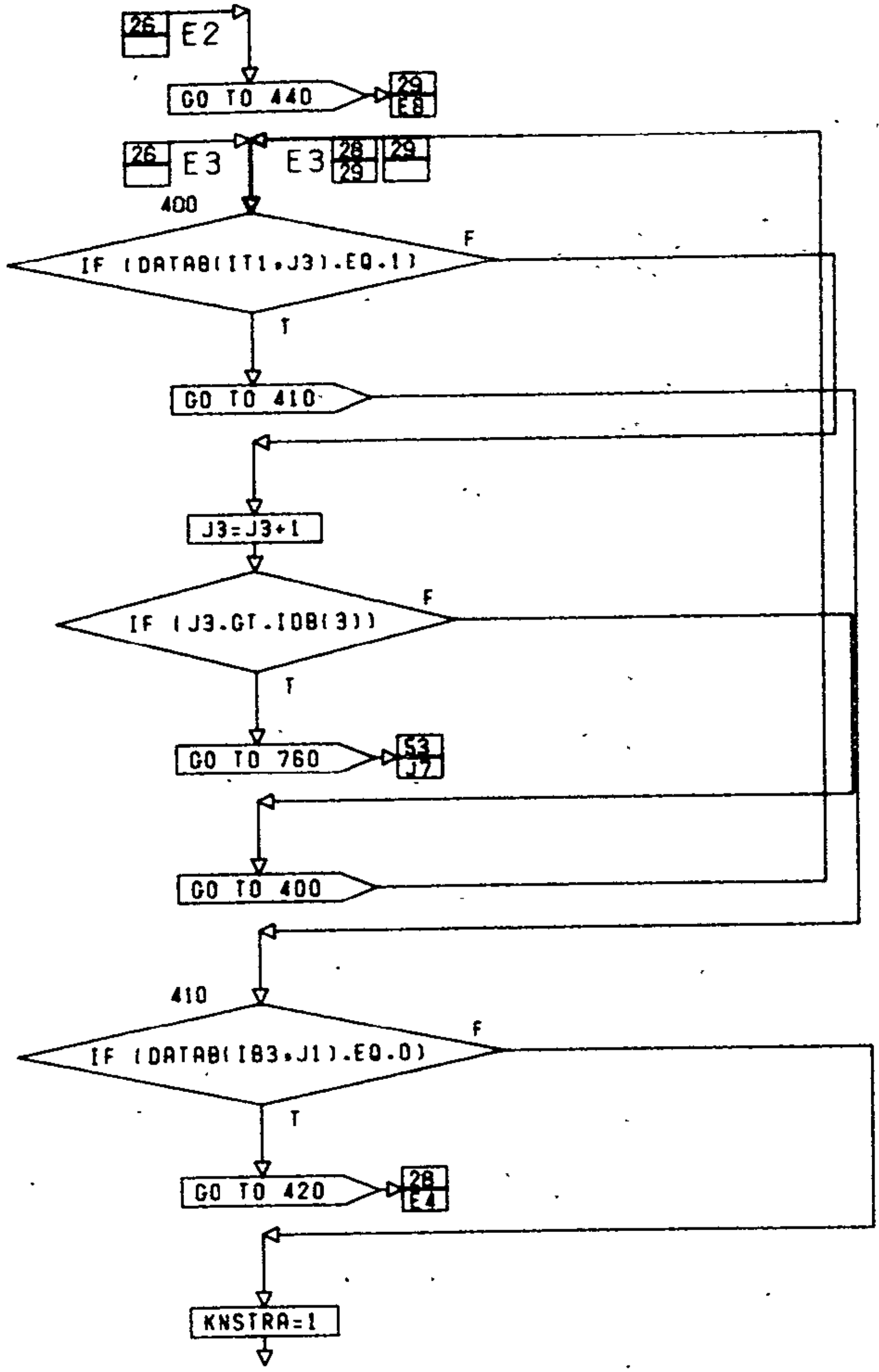
PG 24OF 54


IF (BITRAT(I) .EQ. IBER(I))
F
T
HDLOSS = BER(I,IK)
24
370
CONTINUE
C BANDWIDTH IN DB
24
D9
380
IF (BWIDTH(KXMTR).EQ.-1.E+10)
F
T
BWIDTH(KXMTR)=BITRAT(KXMTR)*1000
B=10*ALOG10(BWIDTH(KXMTR))
C CALCULATION OF ERP
ERP=SIGNOI(KXMTR)+SLOSS+B-GTOT+LMARG(KXMTR)+TCLOSS(KXMTR)+POLOSS+A
NTLOS+MODLOS+HDLOSS-228.6
PW(KXMTR) = 10. **((ERP-GT(KXMTR))/10.)
PRINT 385,KXMTR,PW(KXMTR)
385
FORMAT(4H PW(,I1,4H) = ,E11.4)
C TRANSMITTER SELECTION **

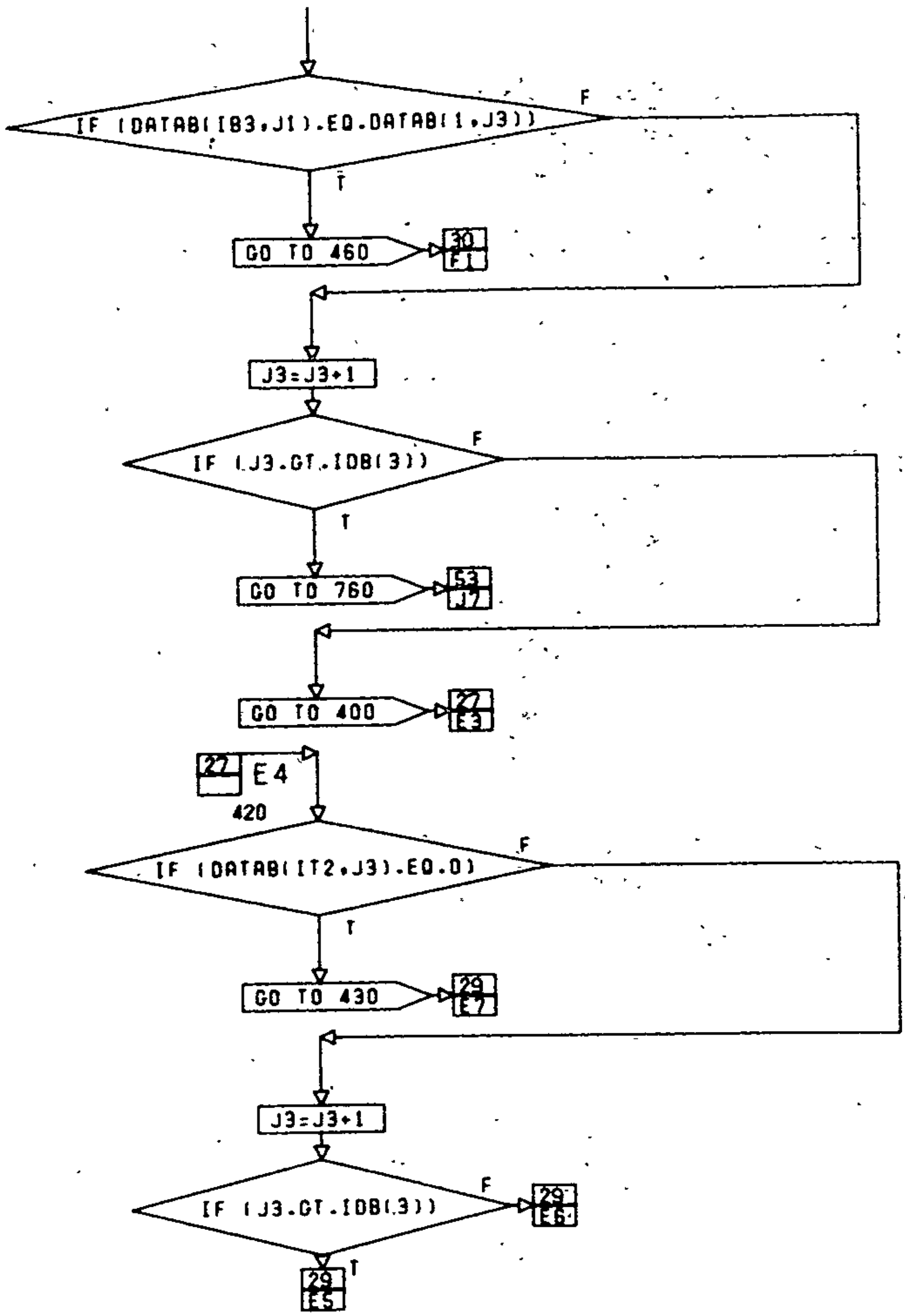
CONT. ON PG 26


IF (PW(KXMTR).LT.20. .OR. DATAB(IA1,J2).EQ.1.)
F
T
GO TO 388
IC = KXMTR + 1
ISPFLG(KXMTR) = 1
IF (J2SAVE(KXMTR).GT. 0 .AND. ITER.EQ.0)
F
T
J2 = J2SAVE(KXMTR)
GO TO 250
18
C3
388
KNSTRA = 0
IC=KXMTR+3
J3=KPIC(IC)
E1
32
32
33
390
IF (LUNI.EQ.0)
F
27
E3
T
27
E2

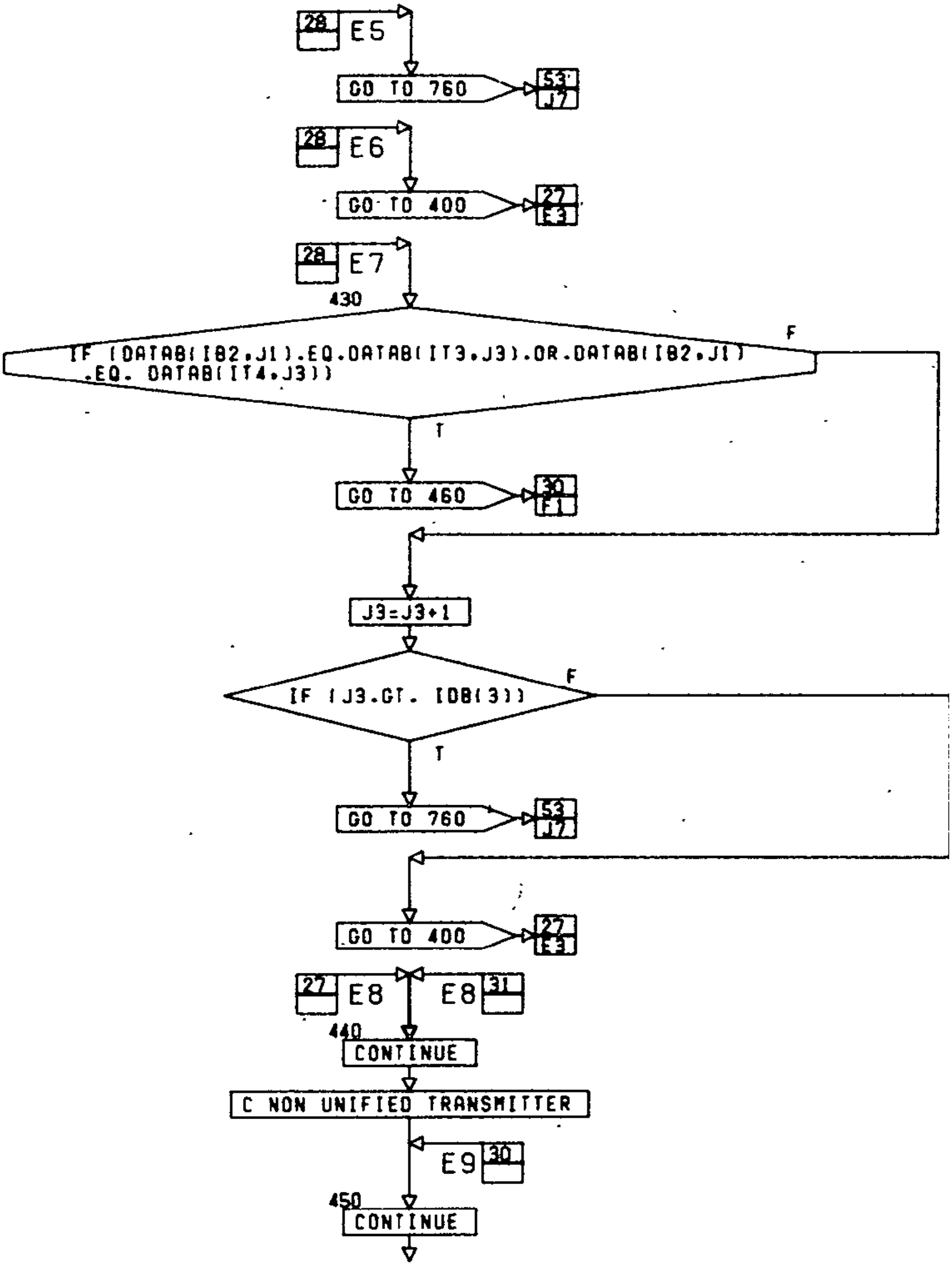
CONT. ON PG 27


26
E2
GO TO 440
29
E8
26
E3
E3
28
29
29
400
IF (DATAB(IT1,J3).EQ.1)
F
T
GO TO 410
J3=J3+1
IF (J3.GT.IDB(3))
F
T
GO TO 760
53
J7
GO TO 400
410
IF (DATAB(IB3,J1).EQ.0)
F
T
GO TO 420
28
E4
KNSTRA=1

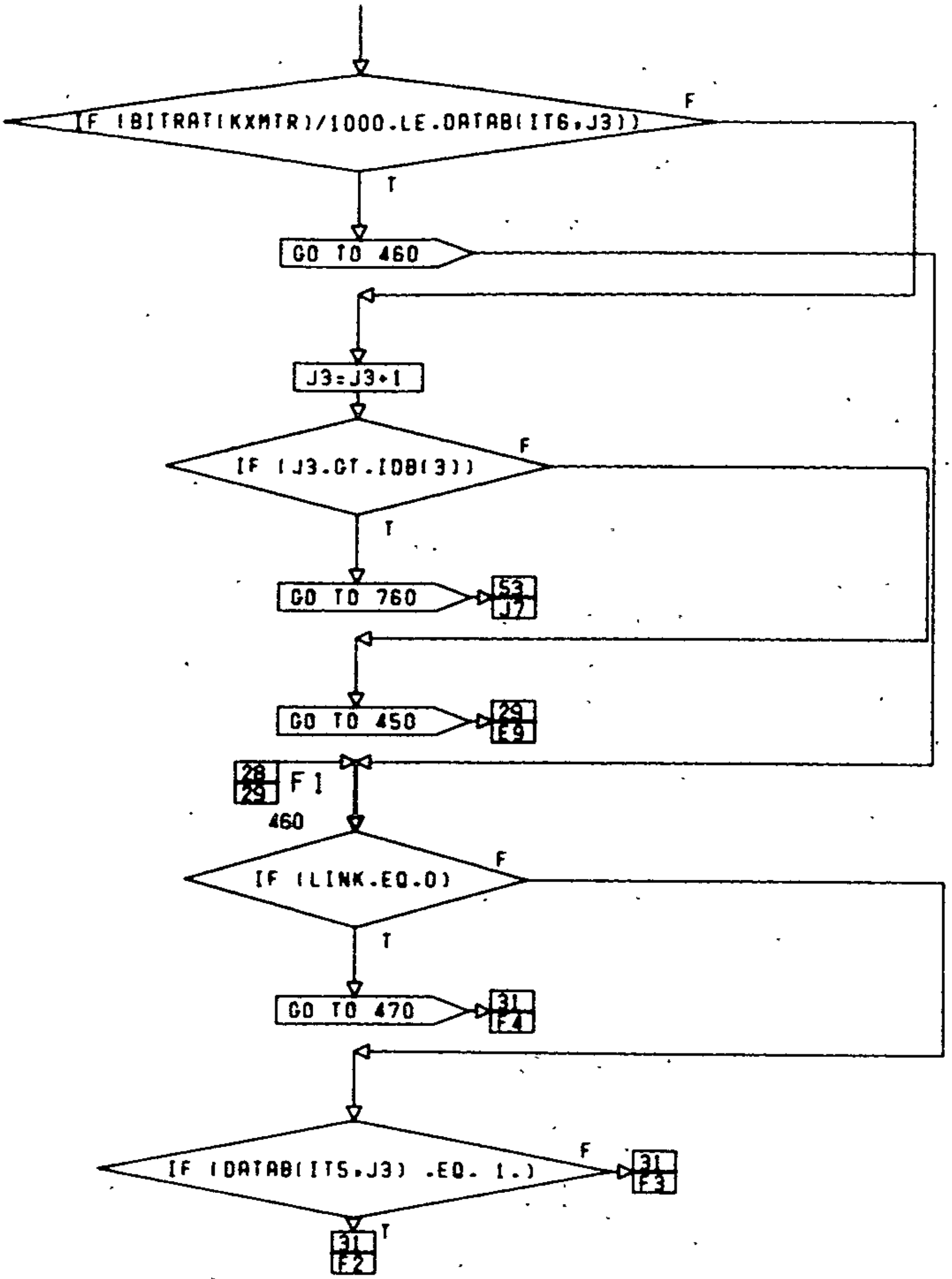
CONT. ON PG 28


IF (DATAB(IB3,J1).EQ.DATAB(1,J3))
F
T
GO TO 460
30
F1
J3=J3+1
IF (J3.GT.IDB(3))
F
T
GO TO 760
53
J7
GO TO 400
27
E3
27
E4
420
IF (DATAB(IT2,J3).EQ.0)
F
T
GO TO 430
29
E7
J3=J3+1
IF (J3.GT.IDB(3))
F
29
E6
T
29
E5

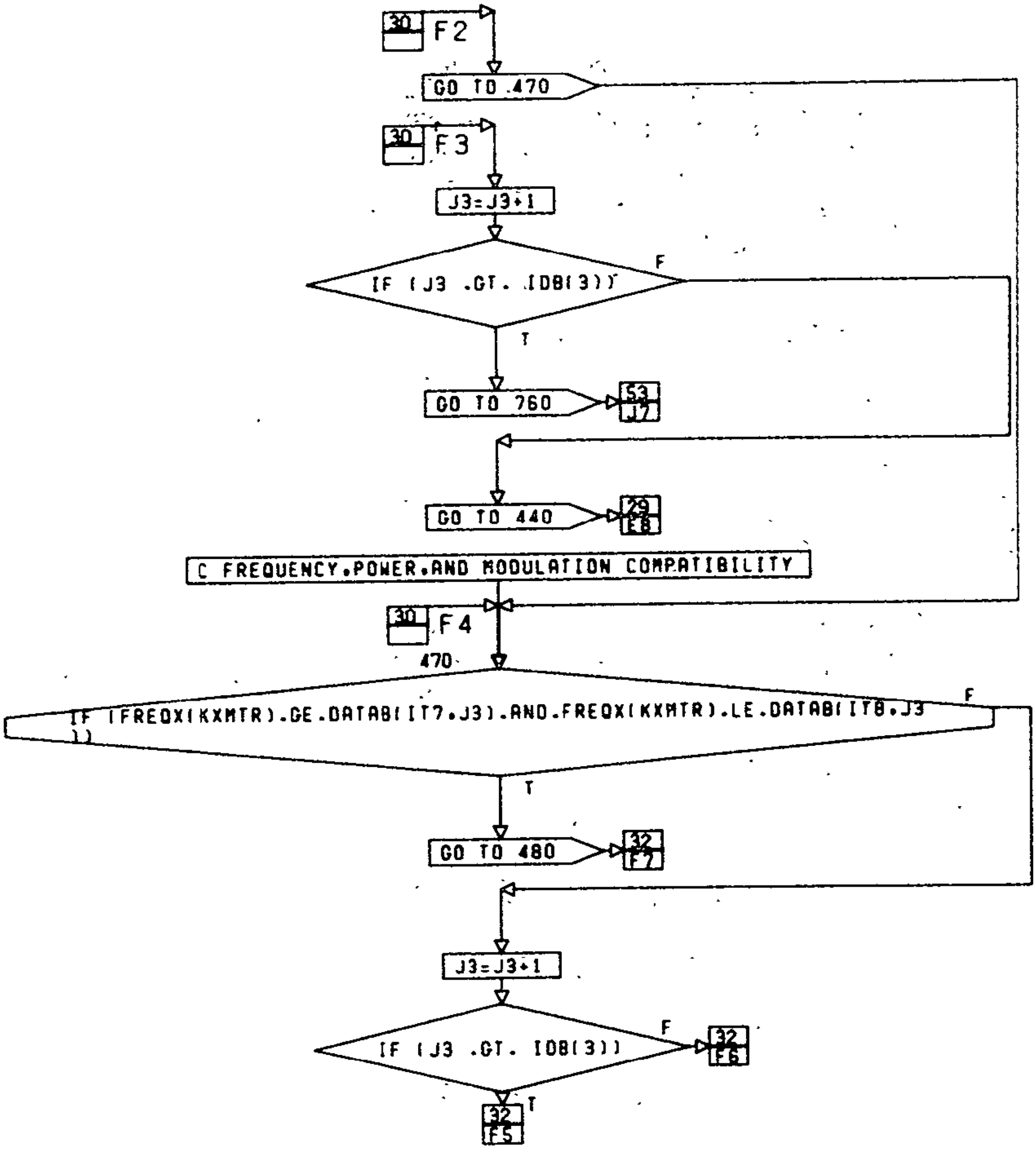
CONT. ON PG 29


28 E5
GO TO 760
53 J7
28 E6
GO TO 400
27 E3
28 E7
430
IF (DATAB(IB2,J1).EQ.DATAB(IT3,J3).OR.DATAB(IB2,J1) .EQ. DATAB(IT4,J3))
F
T
GO TO 460
30 F1
J3=J3+1
IF (J3.GT. IDB(3))
F
T
GO TO 760
53 J7
GO TO 400
27 E3
27 E8
E8 31
440
CONTINUE
C NON UNIFIED TRANSMITTER
E9 30
450
CONTINUE

CONT. ON PG 30

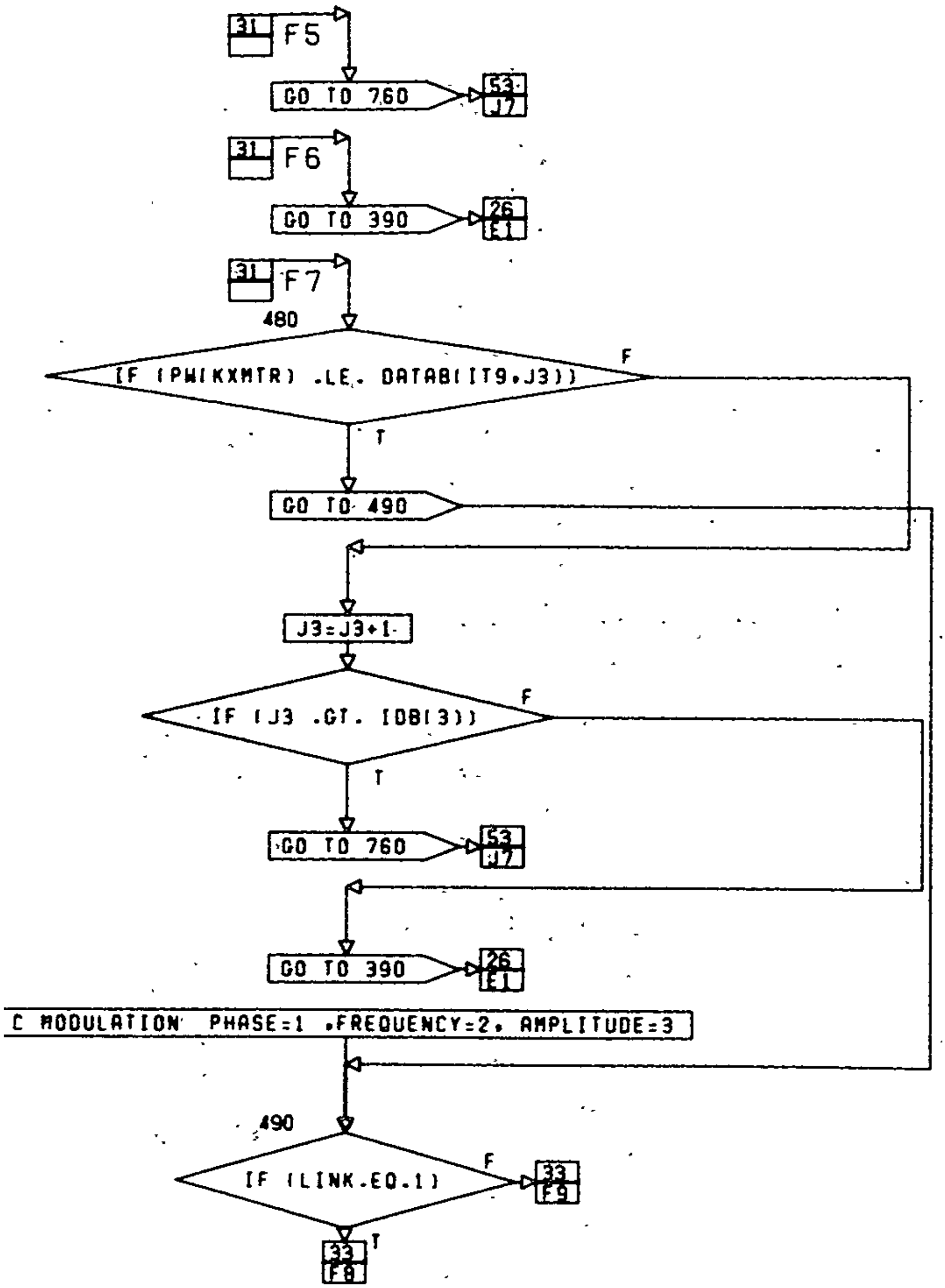

IF (BITRAT(KXMTR)/1000.LE.DATAB(IT6,J3))
F
T
GO TO 460
J3=J3+1
IF (J3.GT.IDB(3))
F
T
GO TO 760
53
J7
GO TO 450
29
E9
28
29
F1
460
IF (LINK.EQ.0)
F
T
GO TO 470
31
F4
IF (DATAB(IT5,J3) .EQ. 1.)
F
31
F3
T
31
F2

CONT. ON PG 31

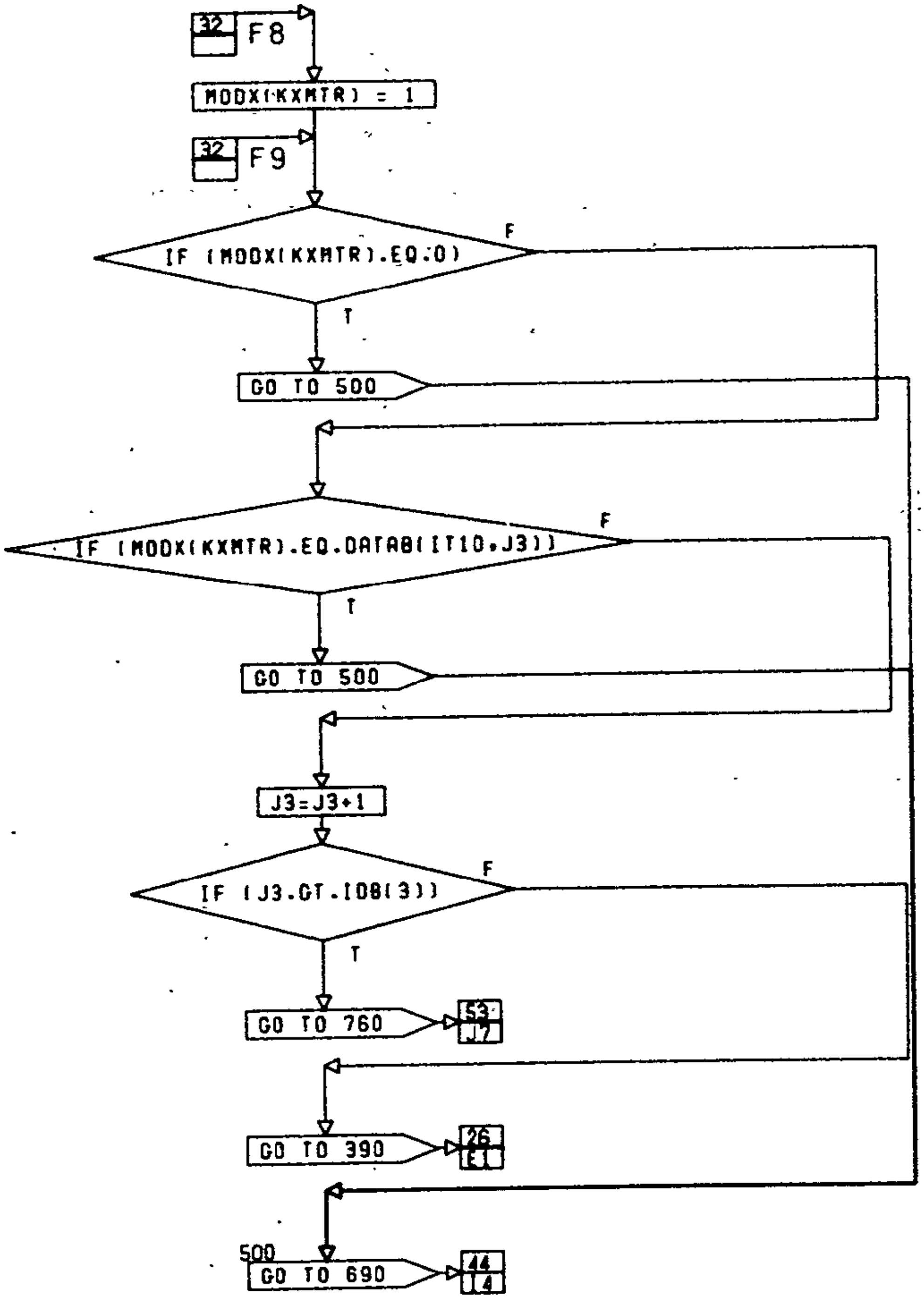


30
F2
GO TO 470
30
F3
J3=J3+1
IF (J3 .GT. IDB(3))
F
T
GO TO 760
53
J7
GO TO 440
29
E8
C FREQUENCY,POWER,AND MODULATION COMPATIBILITY
30
F4
470
IF (FREQX(KXMTR).GE.DATAB(IT7,J3).AND.FREQX(KXMTR).LE.DATAB(IT8,J3
))
F
T
GO TO 480
32
F7
J3=J3+1
IF (J3 .GT. IDB(3))
F
32
F6
T
32
F5

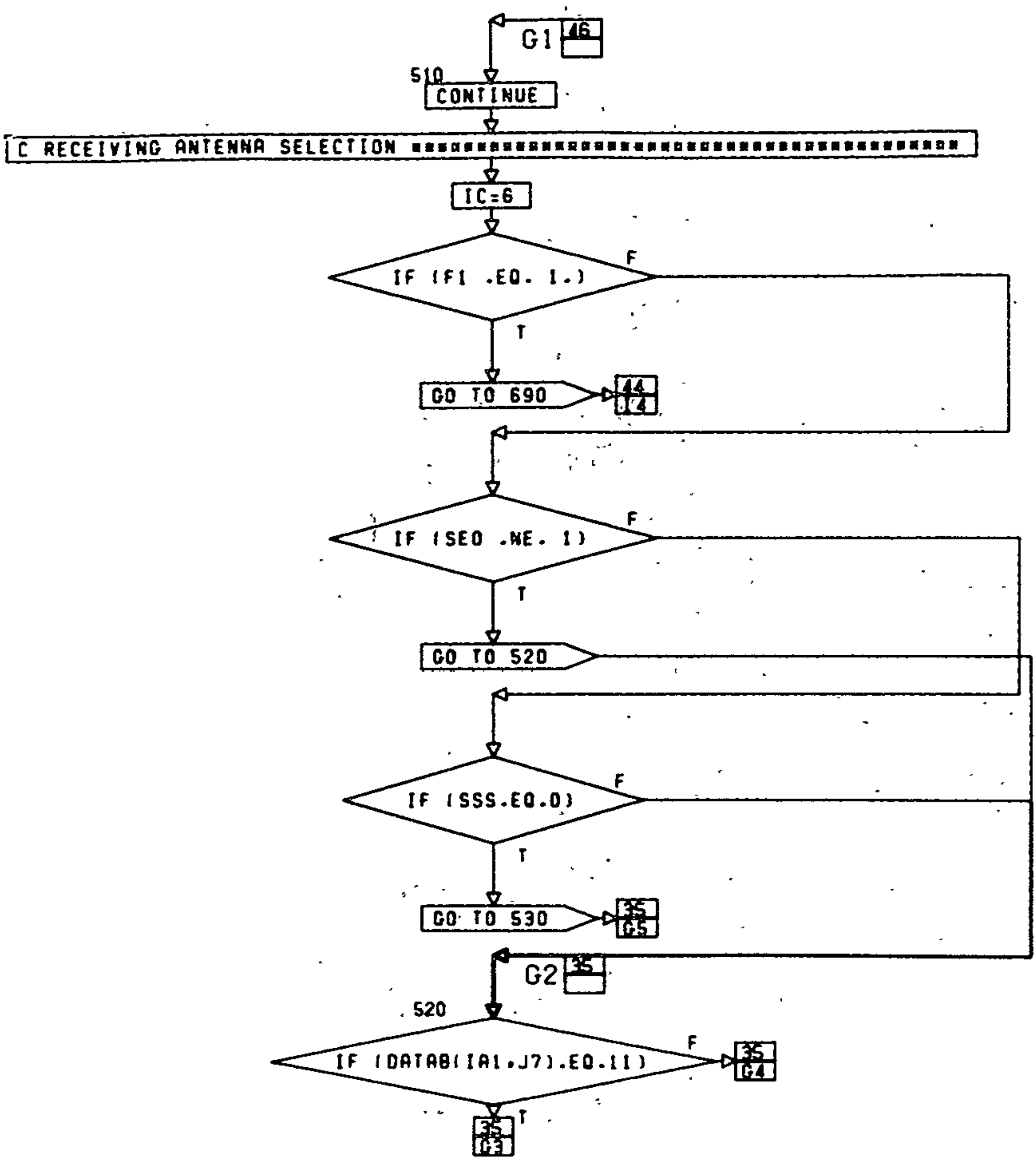
CONT. ON PG 32


31 F5
GO TO 760
53 J7
31 F6
GO TO 390
26 E1
31 F7
480
IF (PW(KXMTR) .LE. DATAB(IT9,J3))
F
T
GO TO 490
J3=J3+1
IF (J3 .GT. IDB(3))
F
T
GO TO 760
53 J7
GO TO 390
26 E1
C MODULATION PHASE=1 ,FREQUENCY=2, AMPLITUDE=3
490
IF (LINK.EQ.1)
F
33 F9
T
33 F8

CONT. ON PG 33

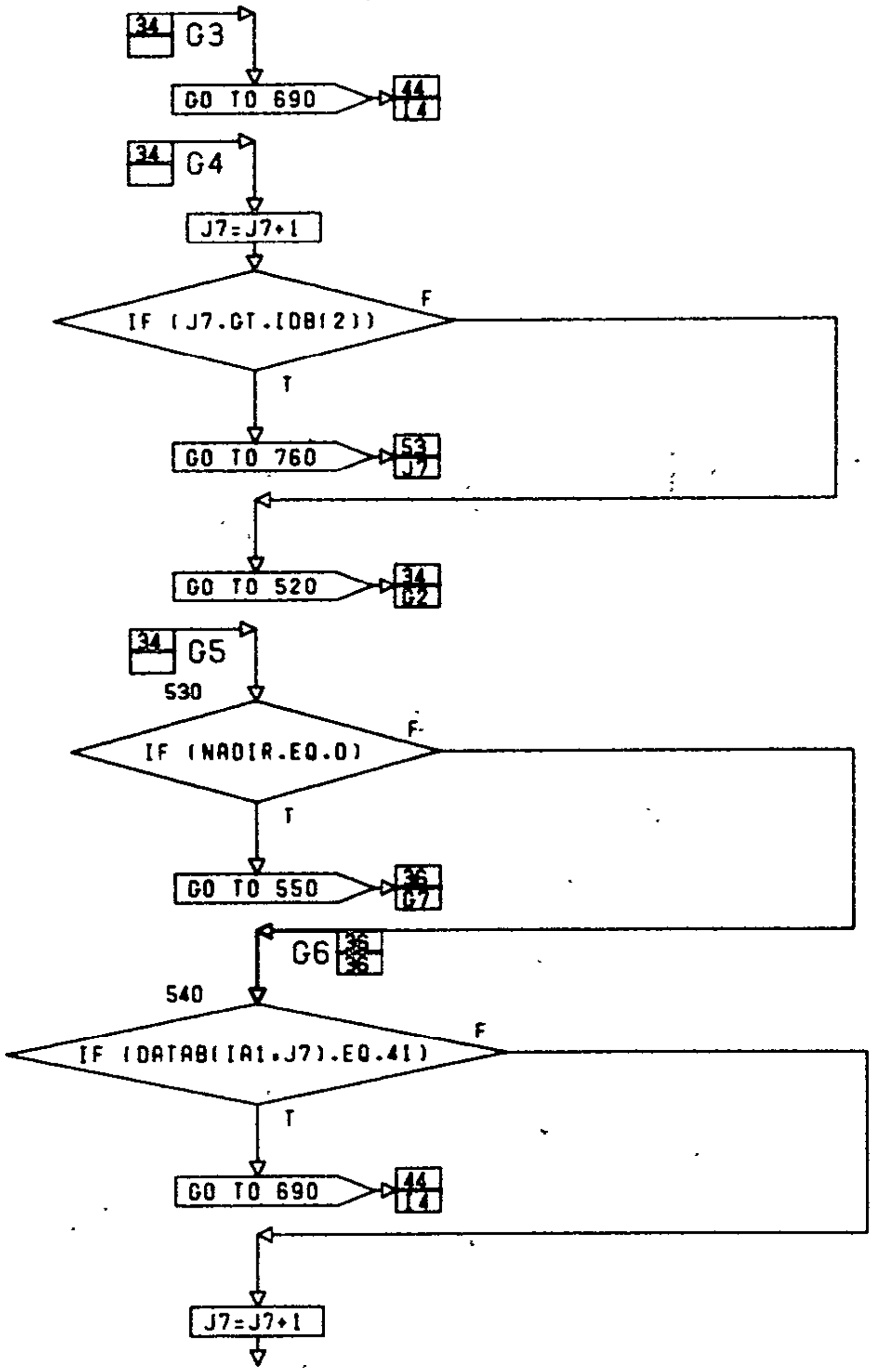

32
F8
MODX(KXMTR) = 1
32
F9
IF (MODX(KXMTR).EQ.0)
F
T
GO TO 500
IF (MODX(KXMTR).EQ.DATA8(IT10,J3))
F
T
GO TO 500
J3=J3+1
IF (J3.GT.ID8(3))
F
T
GO TO 760
53
J7
GO TO 390
26
E1
500
GO TO 690
44
I4

CONT. ON PG 34

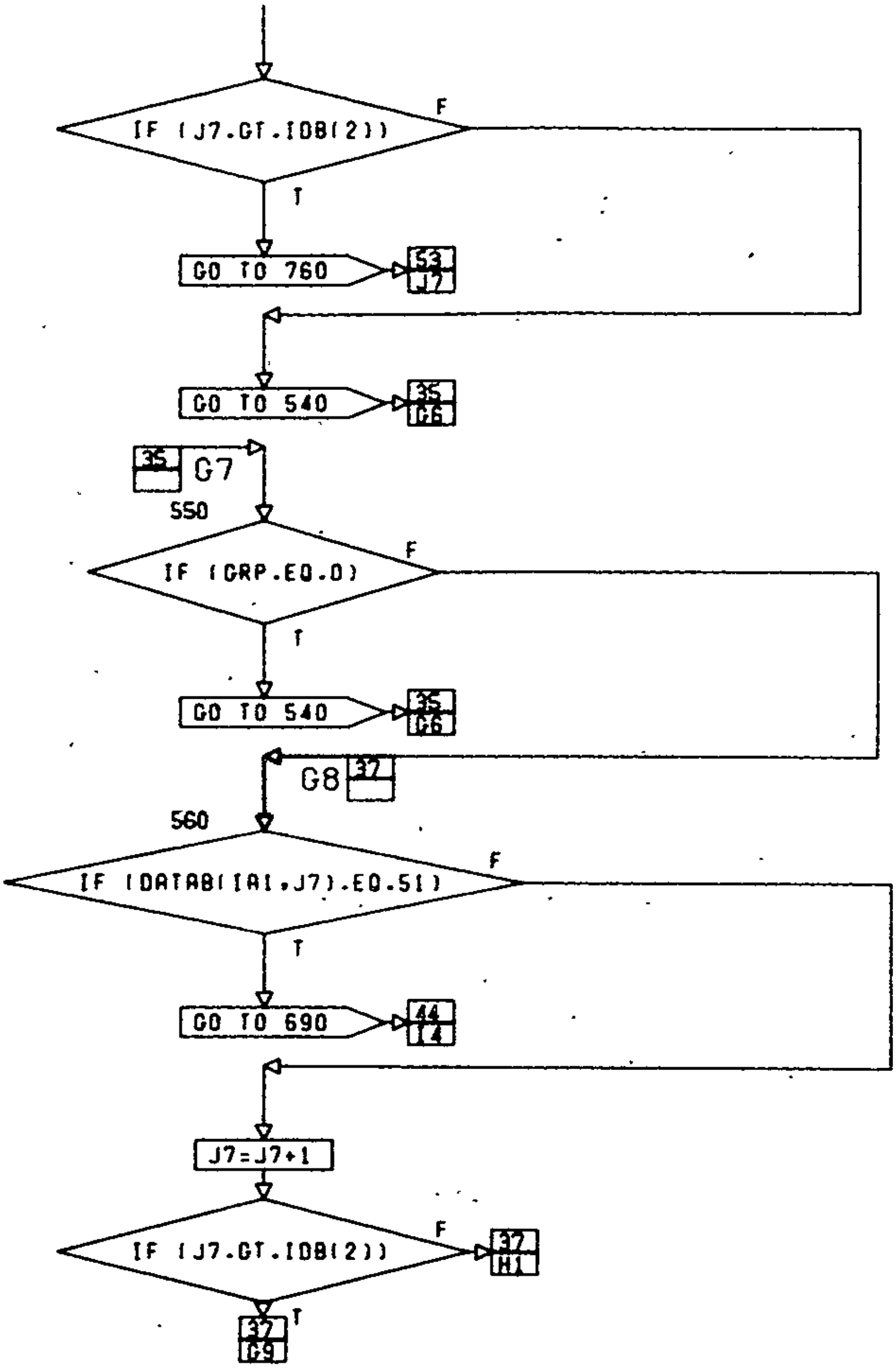


G1 46
510
CONTINUE
C RECEIVING ANTENNA SELECTION
IC=6
IF (F1 .EQ. 1.)
F
T
GO TO 690
44
J4
IF (SEO .NE. 1)
F
T
GO TO 520
IF (SSS.EQ.0)
F
T
GO TO 530
35
G5
G2 35
520
IF (DATAB(IA1,J7).EQ.1)
F
35
G4
T
35
G3

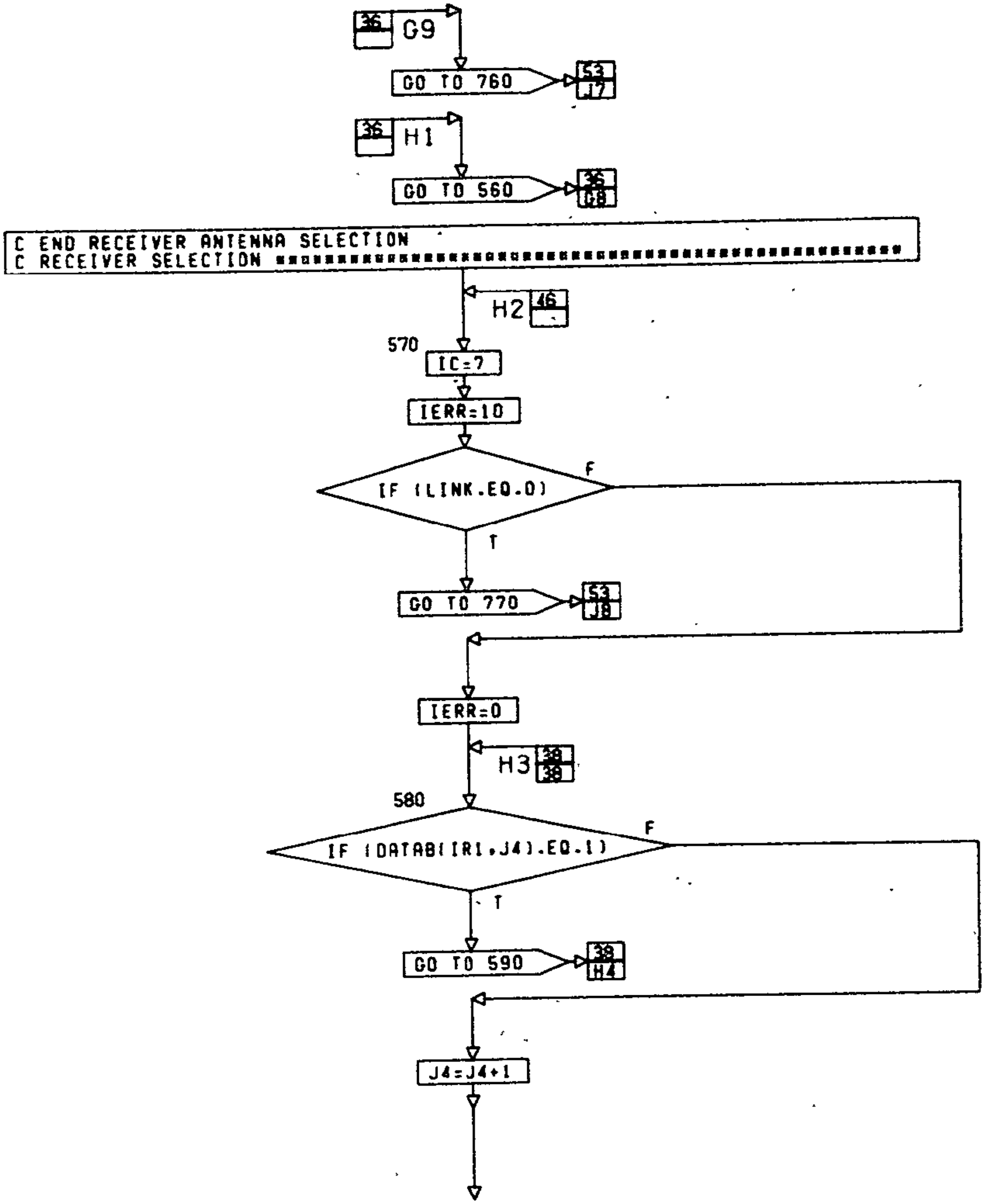
CONT. ON PG 35


34
G3
GO TO 690
44
I4
34
G4
J7=J7+1
IF (J7.GT.IDB(2))
F
T
GO TO 760
53
J7
GO TO 520
34
G2
34
G5
530
IF (NADIR.EQ.0)
F
T
GO TO 550
36
G7
G6
36
540
IF (DATAB(IA1,J7).EQ.4))
F
T
GO TO 690
44
I4
J7=J7+1

CONT. ON PG 36

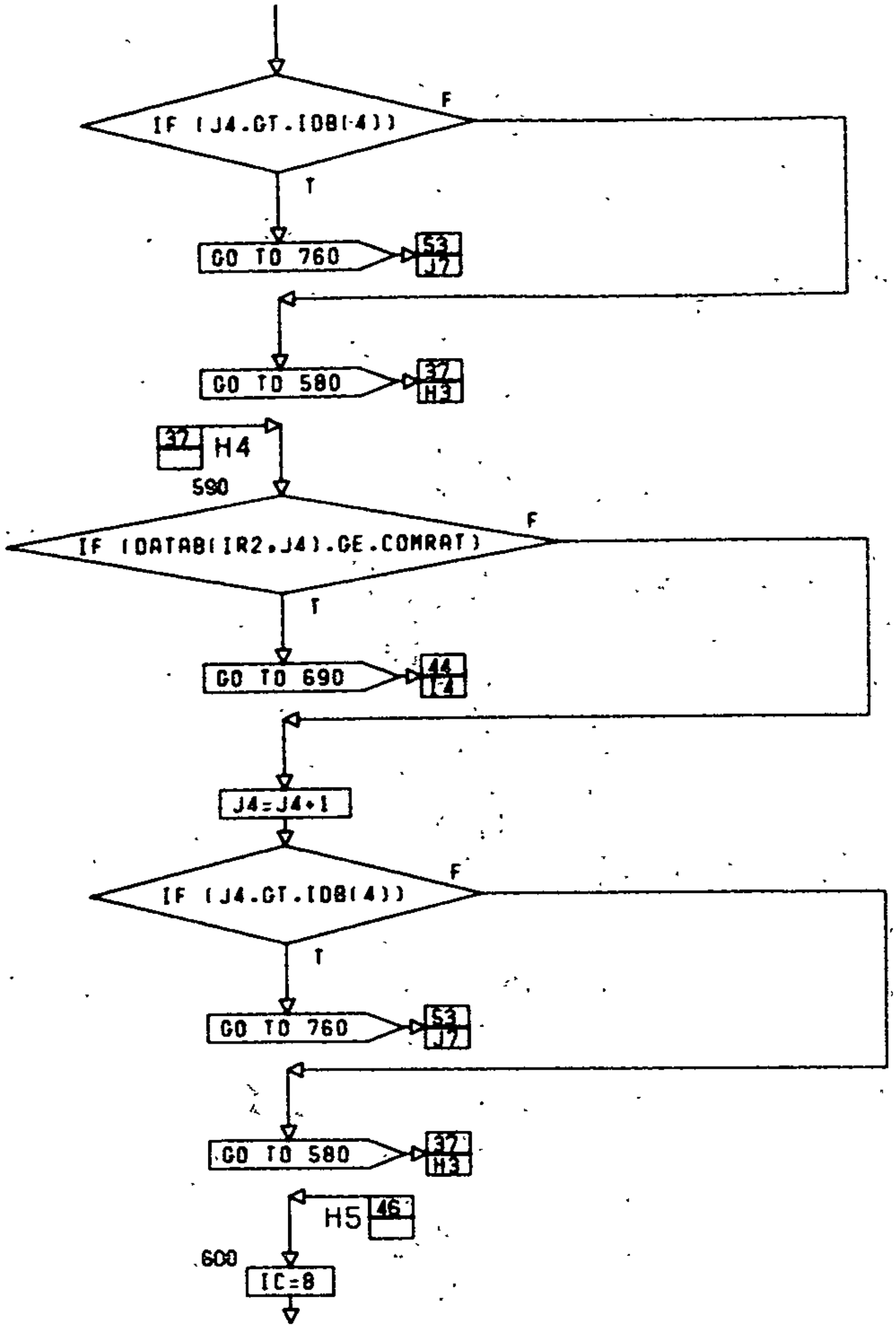

IF (J7.GT.IDB(2))
F
T
GO TO 760
53
J7
GO TO 540
35
G6
35
G7
550
IF (GRP.EQ.0)
F
T
GO TO 540
35
G6
G8
37
560
IF (DATAB(IA1,J7).EQ.5))
F
T
GO TO 690
44
I4
J7=J7+1
IF (J7.GT.IDB(2))
F
37
H1
T
37
G9

CONT. ON PG 37

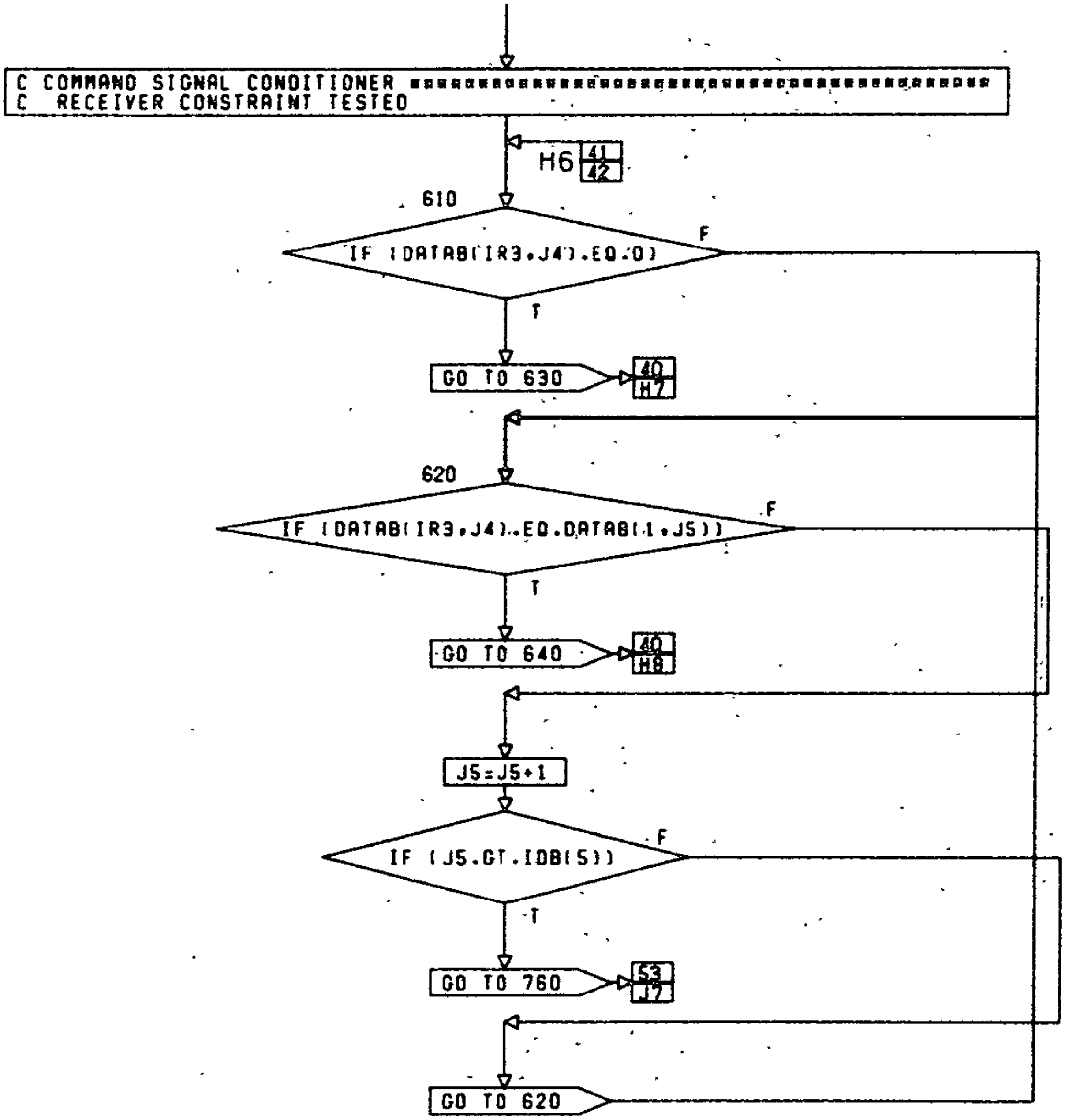


36 G9
GO TO 760
53 J7
36 H1
GO TO 560
36 G8
C END RECEIVER ANTENNA SELECTION
C RECEIVER SELECTION **
H2 46
570
IC=7
IERR=10
IF (LINK.EQ.0)
F
T
GO TO 770
53 J8
IERR=0
H3 38 38
580
IF (DATAB(IR1,J4).EQ.1)
F
T
GO TO 590
38 H4
J4=J4+1

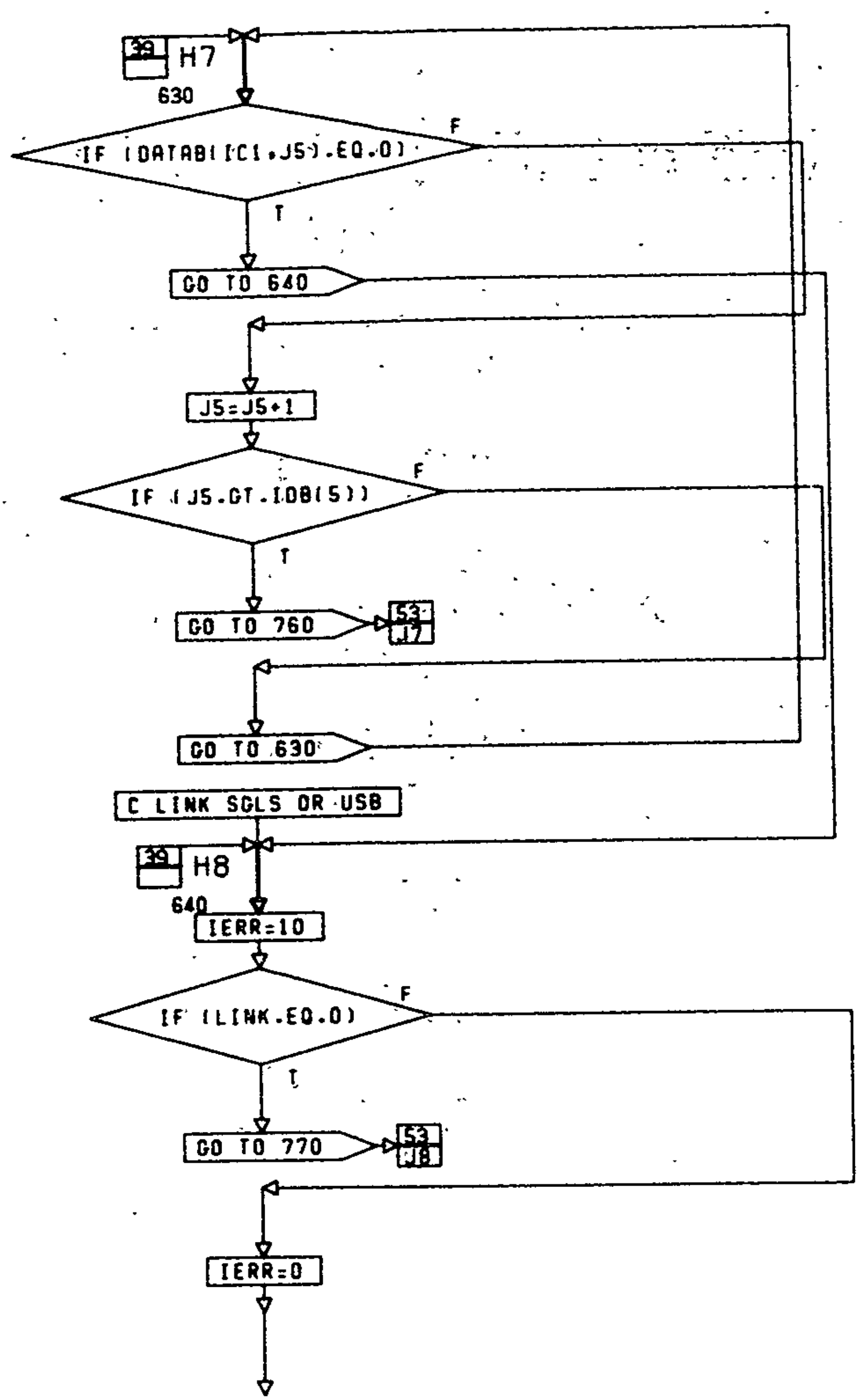
CONT. ON PG 38


IF (J4.GT.IDB(4))
F
T
GO TO 760
53
J7
GO TO 580
37
H3
37
H4
590
IF (DATAB(IR2,J4).GE.COMRAT)
F
T
GO TO 690
44
I4
J4=J4+1
IF (J4.GT.IDB(4))
F
T
GO TO 760
53
J7
GO TO 580
37
H3
H5
46
600
IC=8

CONT. ON PG 39

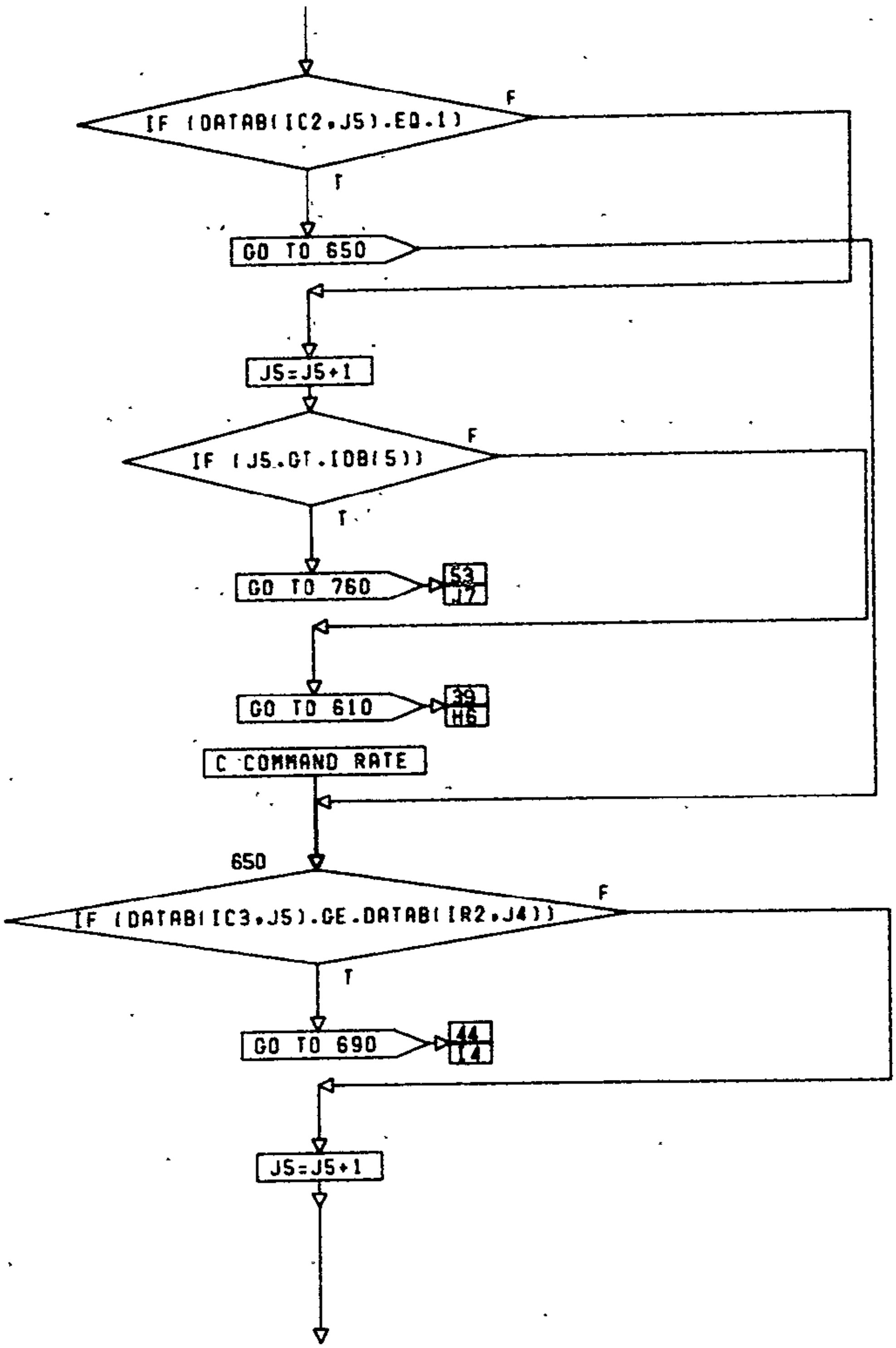

C COMMAND SIGNAL CONDITIONER
C RECEIVER CONSTRAINT TESTED
H6 41 42
610
IF (DATAB(IR3,J4).EQ.0)
F
T
GO TO 630
40 H7
620
IF (DATAB(IR3,J4).EQ.DATAB(1,J5))
F
T
GO TO 640
40 H8
J5=J5+1
IF (J5.GT.IDB(5))
F
T
GO TO 760
53 J7
GO TO 620

CONT. ON PG 40

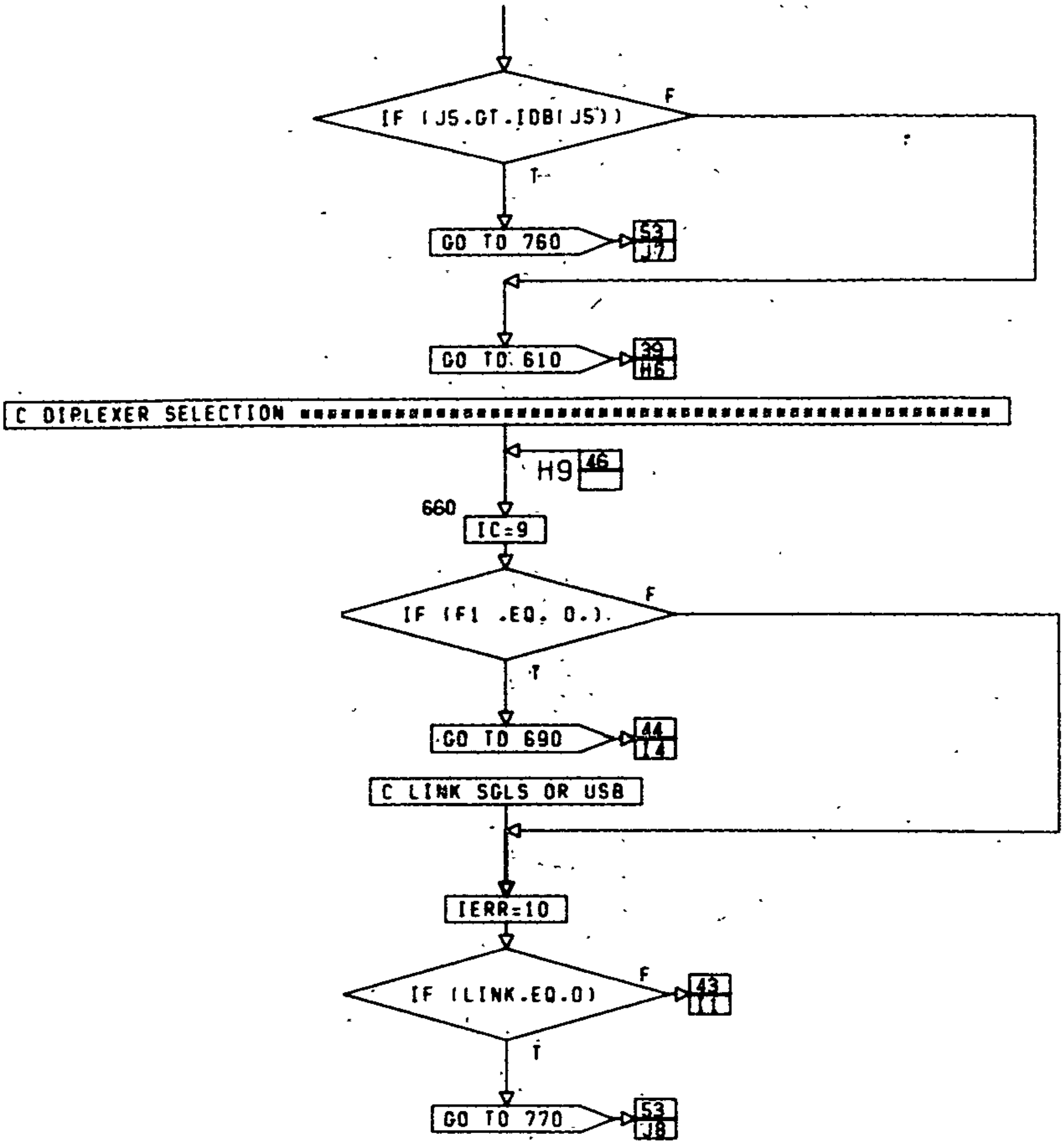


CONT. ON PG 41

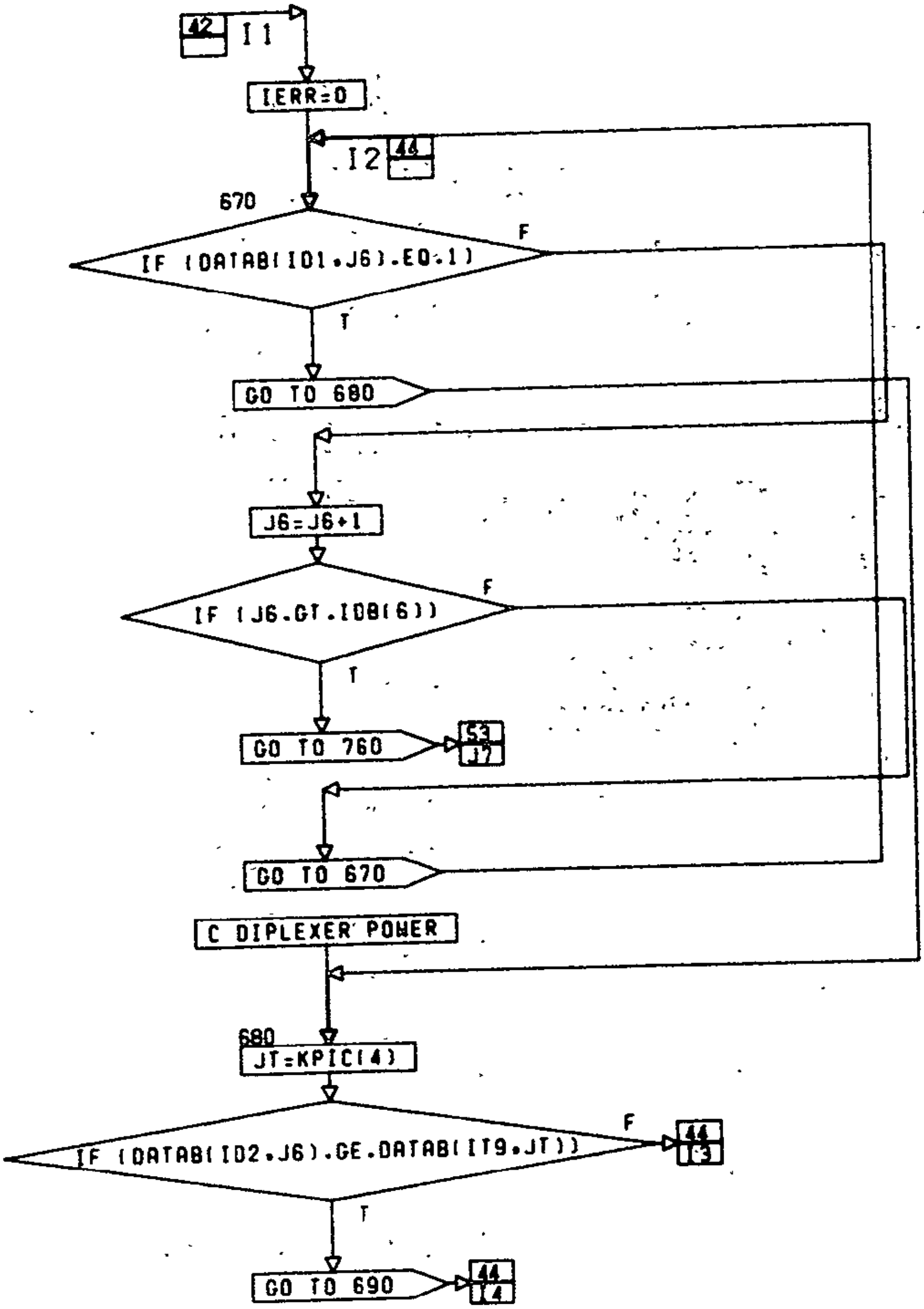
PG 40 OF 54


IF (DATAB(IC2,J5).EQ.1)
F
T
GO TO 650
J5=J5+1
IF (J5.GT.IDB(5))
F
T
GO TO 760
53
J7
GO TO 610
39
H6
C COMMAND RATE
650
IF (DATAB(IC3,J5).GE.DATAB(IR2,J4))
F
T
GO TO 690
44
I4
J5=J5+1

CONT. ON PG 42

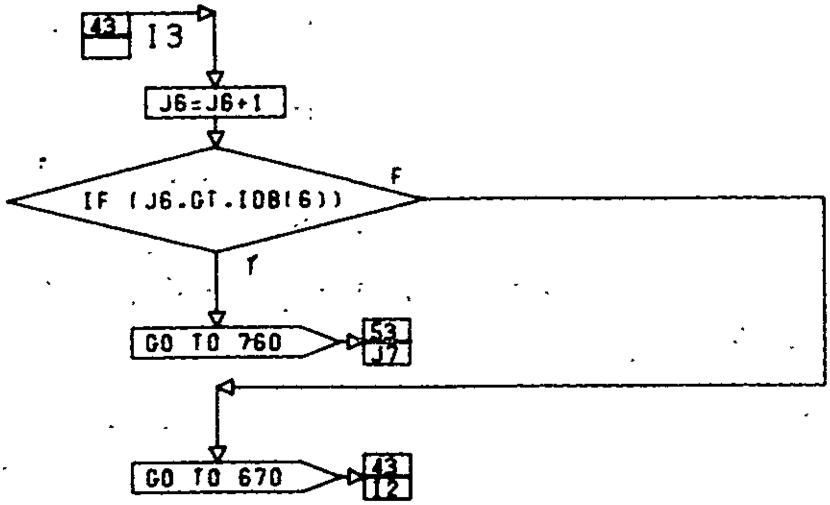

IF (J5.GT.IDB(J5))
F
T
GO TO 760
53
J7
GO TO 610
39
H6
C DIPLEXER SELECTION
H9
46
660
IC=9
IF (F1 .EQ. 0.)
F
T
GO TO 690
44
I4
C LINK SGLS OR USB
IERR=10
IF (LINK.EQ.0)
F
43
I1
T
GO TO 770
53
J8

CONT. ON PG 43

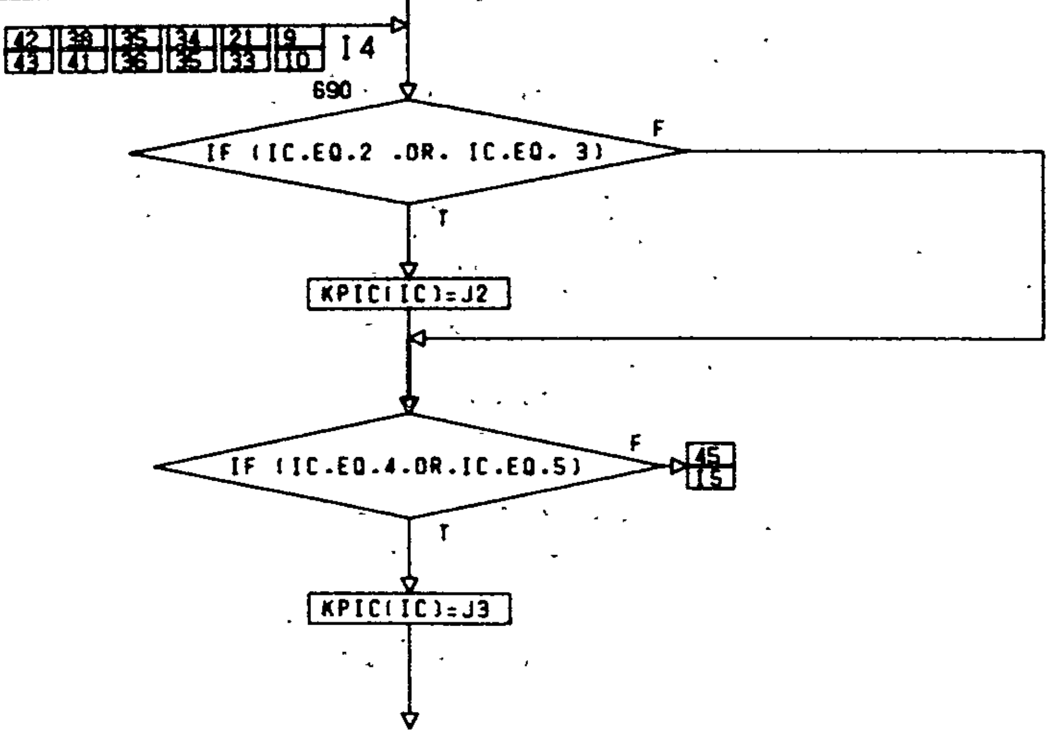


42
I1
IERR=0
I2
44
670
IF (DATAB(ID1,J6).EQ.1)
F
T
GO TO 680
J6=J6+1
IF (J6.GT.IDB(6))
F
T
GO TO 760
53
J7
GO TO 670
C DIPLEXER POWER
680
JT=KPIC(4)
IF (DATAB(ID2,J6).GE.DATAB(IT9,JT))
F
44
I3
T
GO TO 690
44
I4

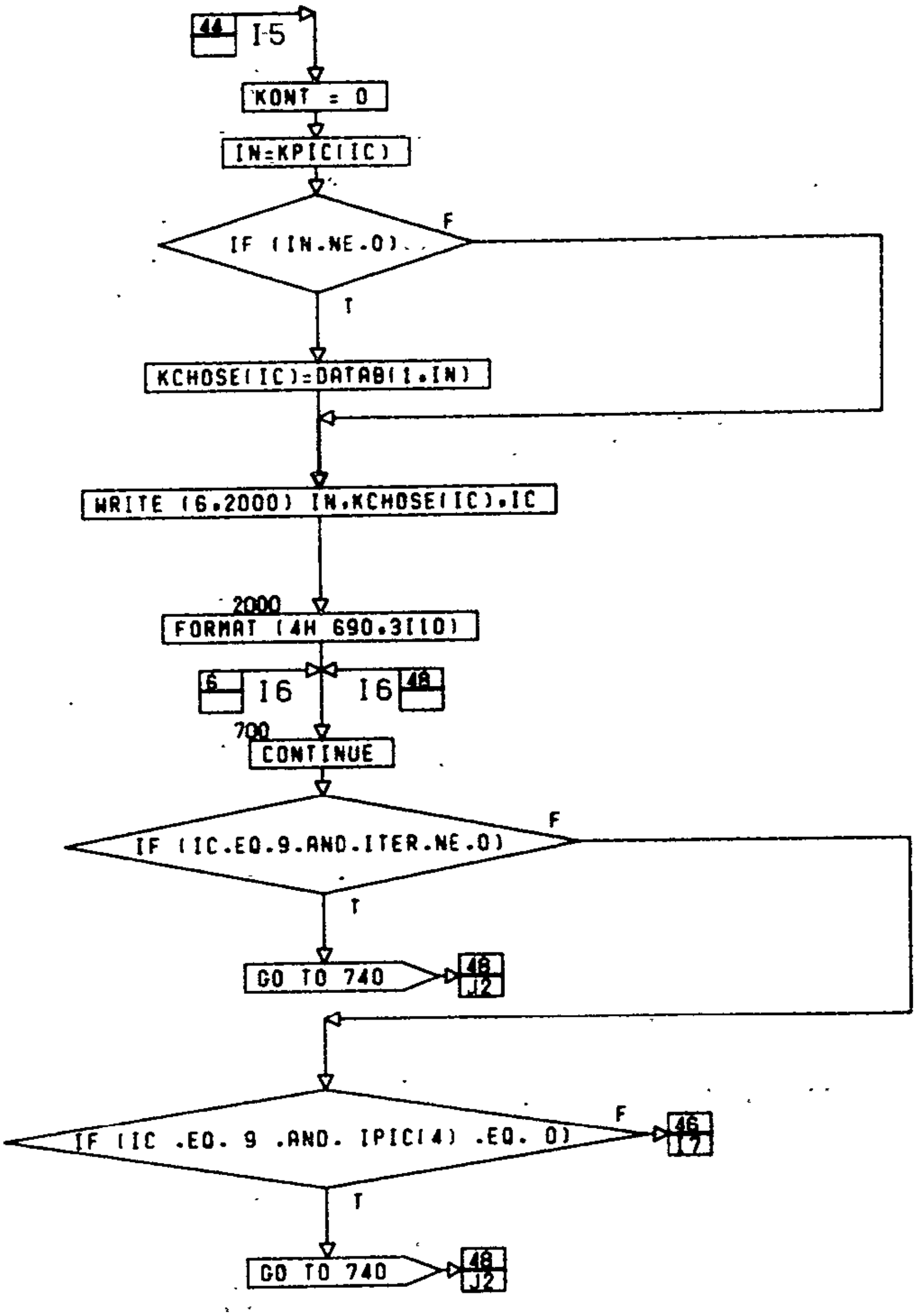
CONT. ON PG 44



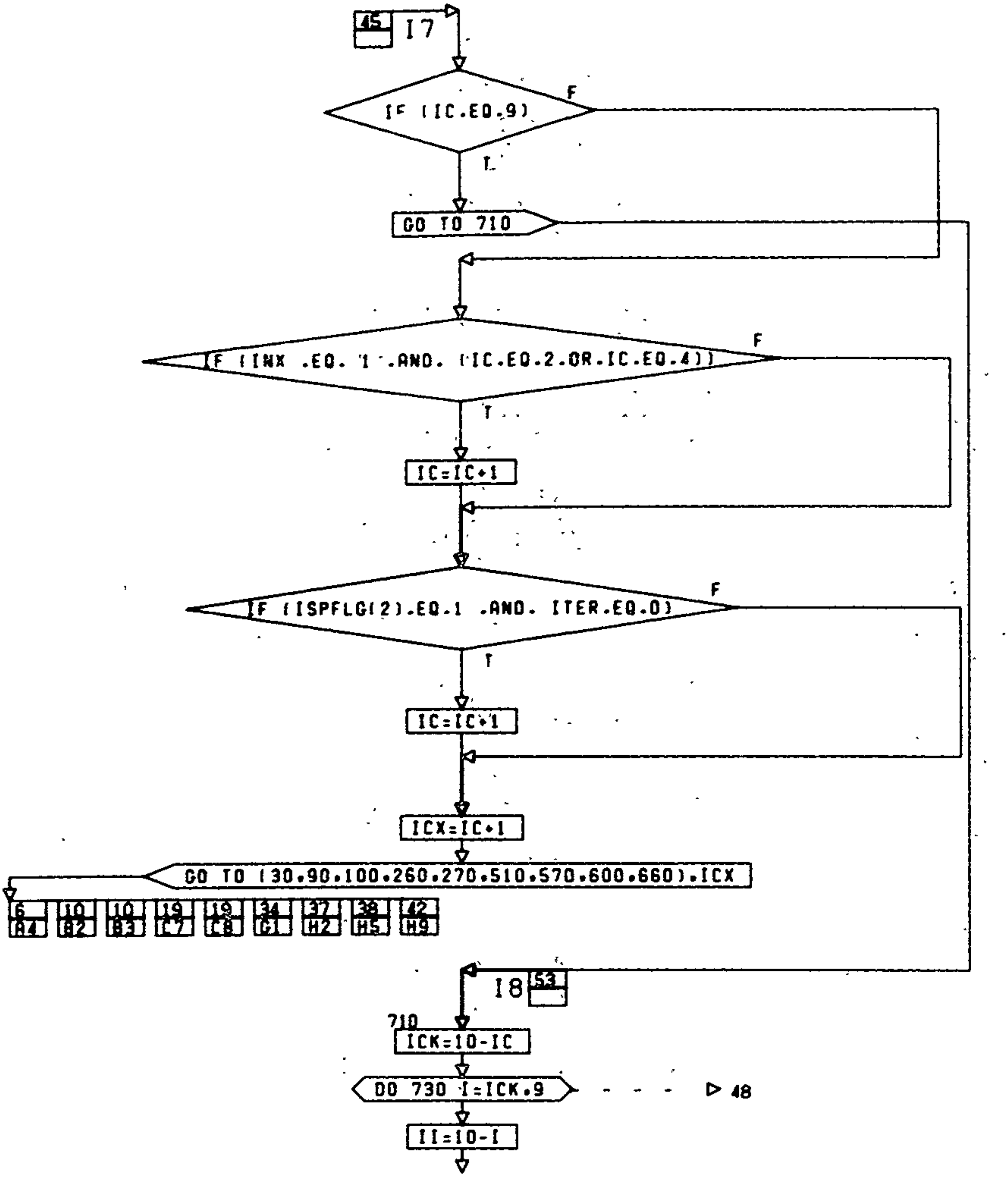

```
C PROGRAM CONTROL AND BOOK KEEPING  ************************************
C   J1-BASEBAND ASSEMBLY UNIT
C   J2-TRANSMITTER ANTENNAS
C   J3-TRANSMITTER
C   J4-RECEIVER
C   J5-SIGNAL CONDITIONER
C   J6-DIPLEXER
C     J7-RECEIVER ANTENNA
```



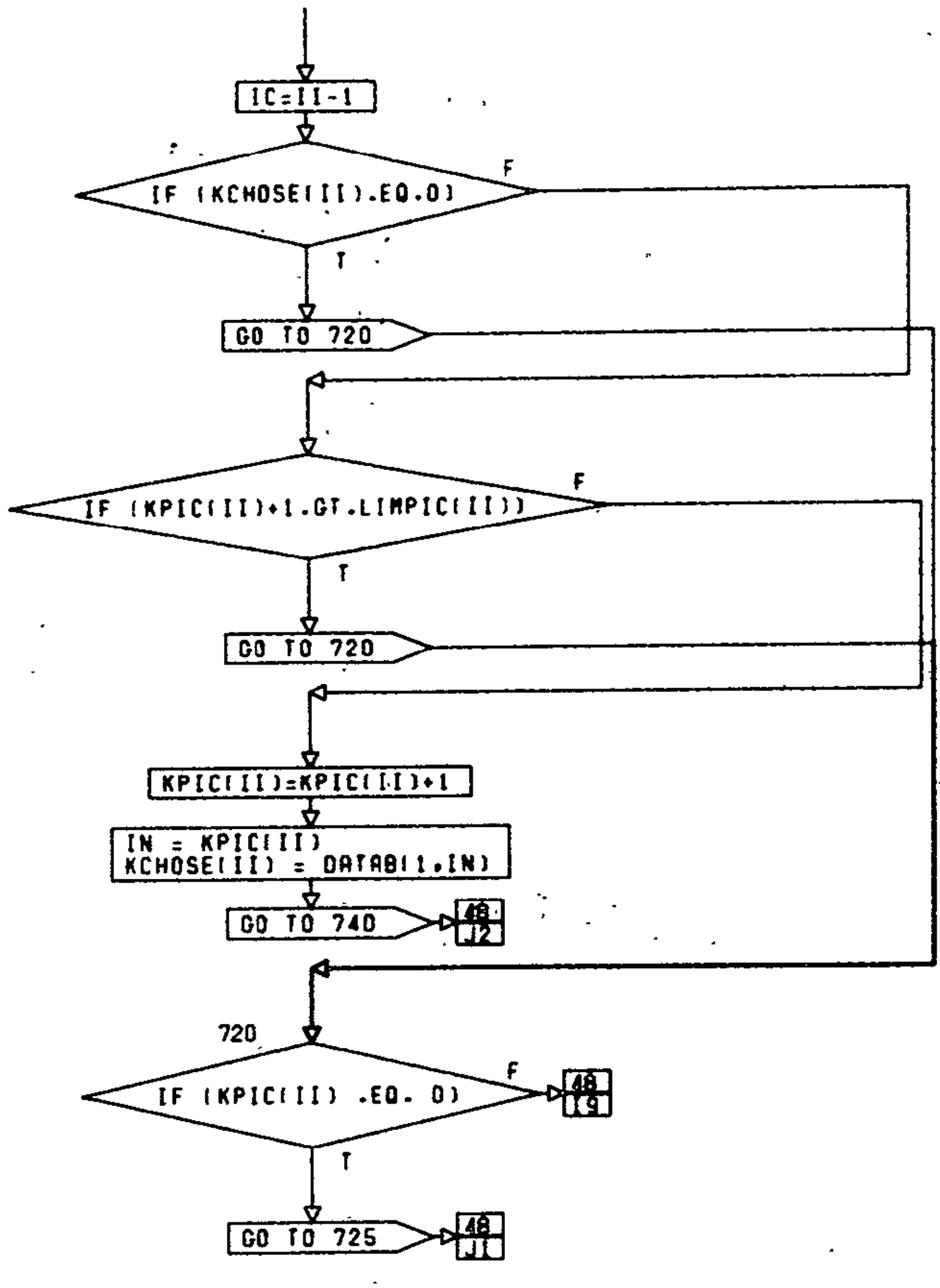
CONT. ON PG 45


44
I-5
KONT = 0
IN=KPIC(IC)
IF (IN.NE.0)
F
T
KCHOSE(IC)=DATAB(1,IN)
WRITE (6,2000) IN,KCHOSE(IC),IC
2000
FORMAT (4H 690,3I10)
6
I6
I6
48
700
CONTINUE
IF (IC.EQ.9.AND.ITER.NE.0)
F
T
GO TO 740
48
J2
IF (IC .EQ. 9 .AND. IPIC(4) .EQ. 0)
F
46
I7
T
GO TO 740
48
J2

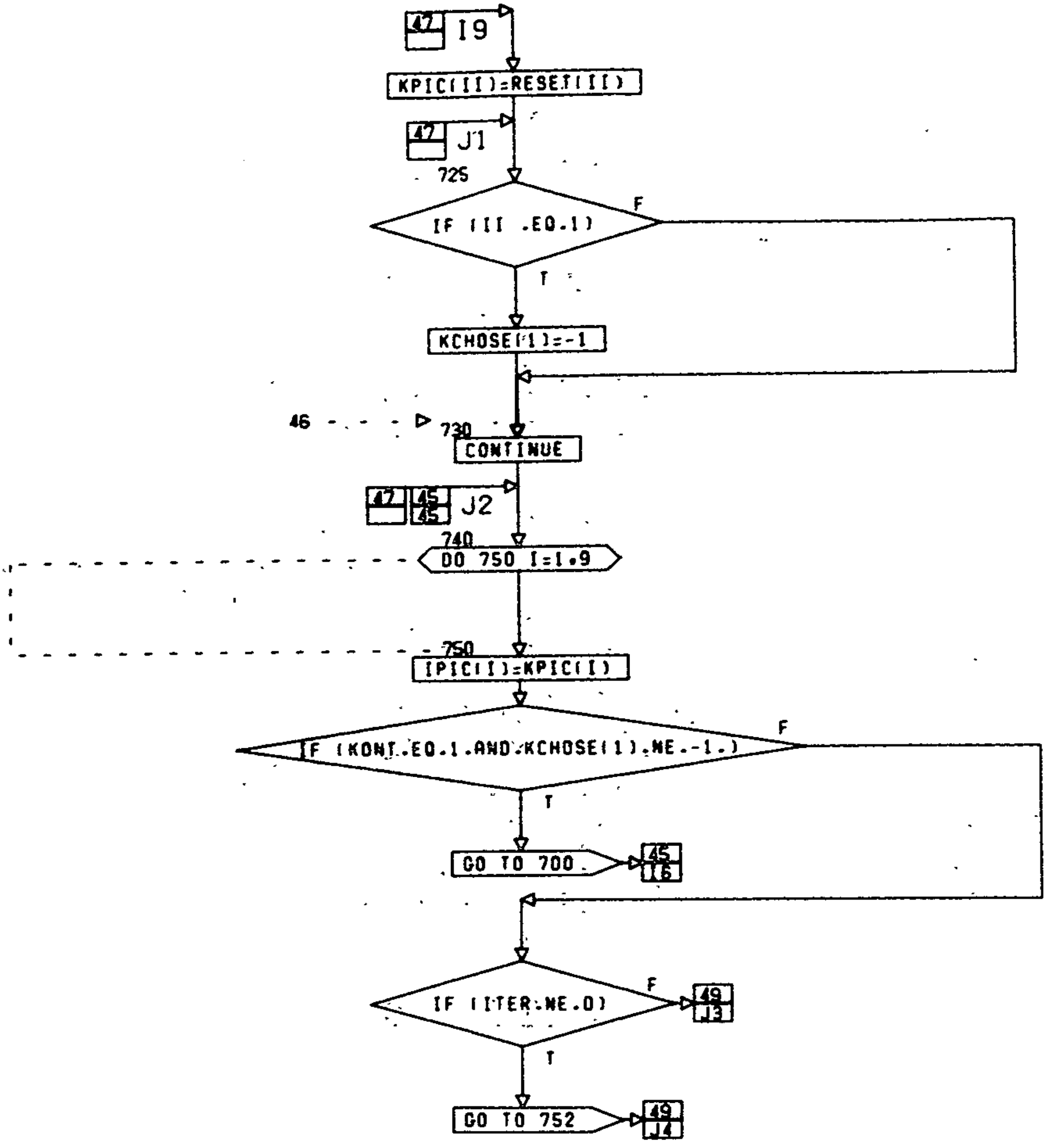
CONT. ON PG 46


45
I7
IF (IC.EQ.9)
F
T
GO TO 710
IF (INX .EQ. 1 .AND. (IC.EQ.2.OR.IC.EQ.4))
F
T
IC=IC+1
IF (ISPFLG(2).EQ.1 .AND. ITER.EQ.0)
F
T
IC=IC+1
ICX=IC+1
GO TO (30,90,100,260,270,510,570,600,660),ICX
6 A4
10 B2
10 B3
19 C7
19 C8
34 G1
37 H2
38 H5
42 H9
I8
53
710
ICK=10-IC
DO 730 I=ICK,9
48
II=10-I

CONT. ON PG 47

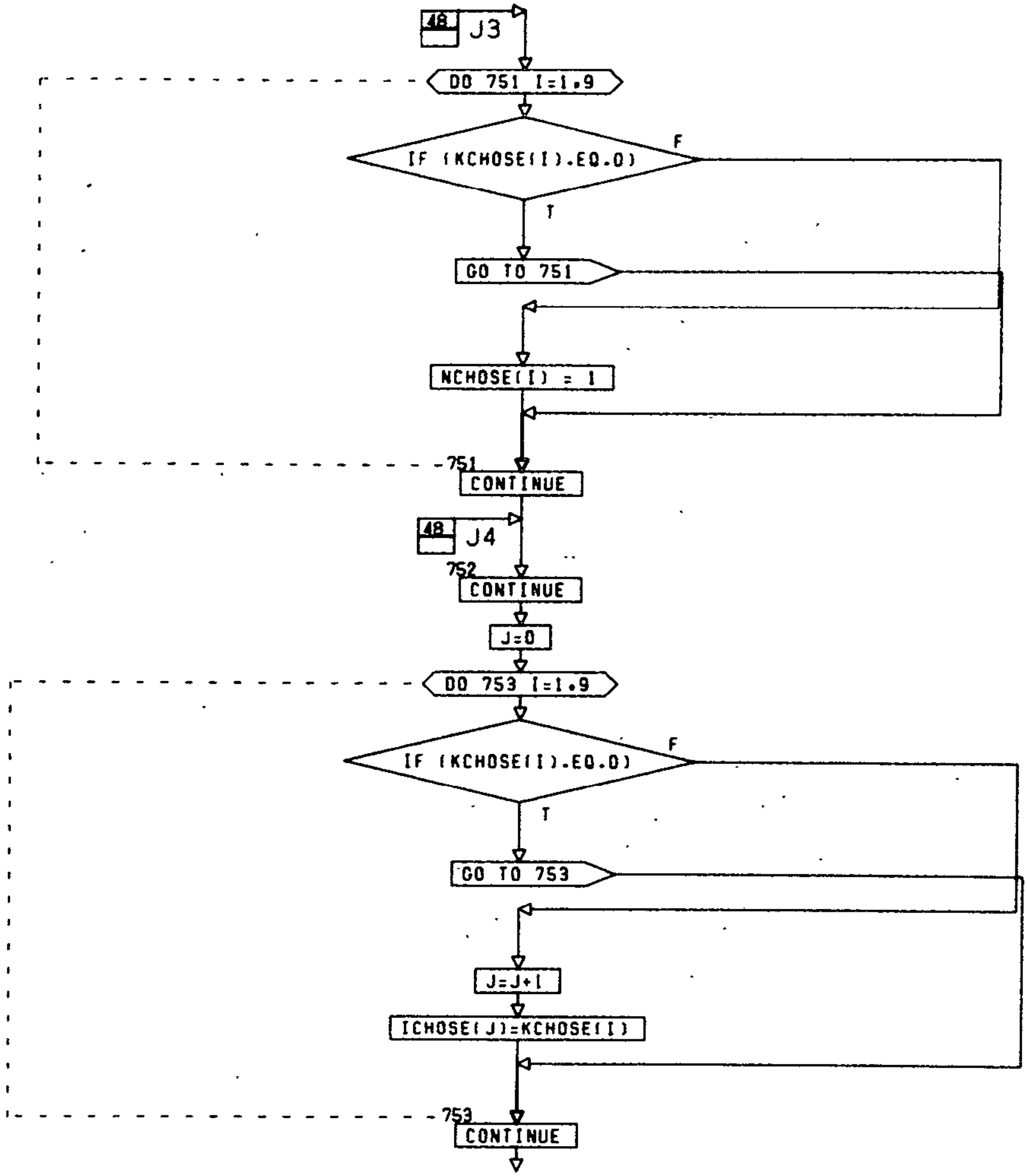

IC=II-1
IF (KCHOSE(II).EQ.0)
F
T
GO TO 720
IF (KPIC(II)+1.GT.LIMPIC(II))
F
T
GO TO 720
KPIC(II)=KPIC(II)+1
IN = KPIC(II)
KCHOSE(II) = DATAB(1,IN)
GO TO 740
48
J2
720
IF (KPIC(II) .EQ. 0)
F
48
I9
T
GO TO 725
48
J1

CONT. ON PG 48

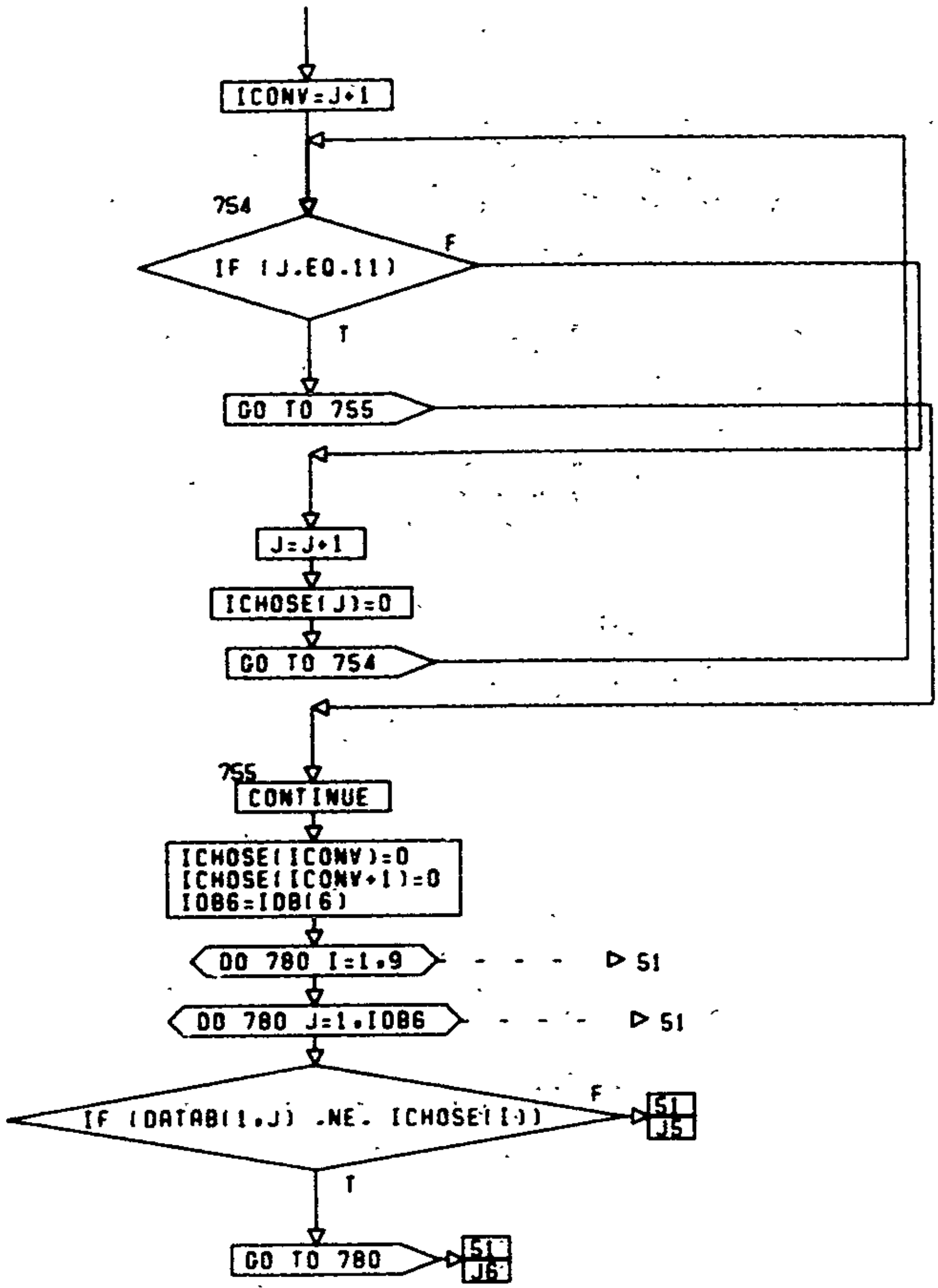


47
I9
KPIC(II)=RESET(II)
47
J1
725
IF (II .EQ.1)
F
T
KCHOSE(1)=-1
46
730
CONTINUE
47
45
45
J2
740
DO 750 I=1,9
750
IPIC(I)=KPIC(I)
IF (KONT.EQ.1.AND.KCHOSE(1).NE.-1.)
F
T
GO TO 700
45
I6
IF (ITER.NE.0)
F
49
J3
T
GO TO 752
49
J4

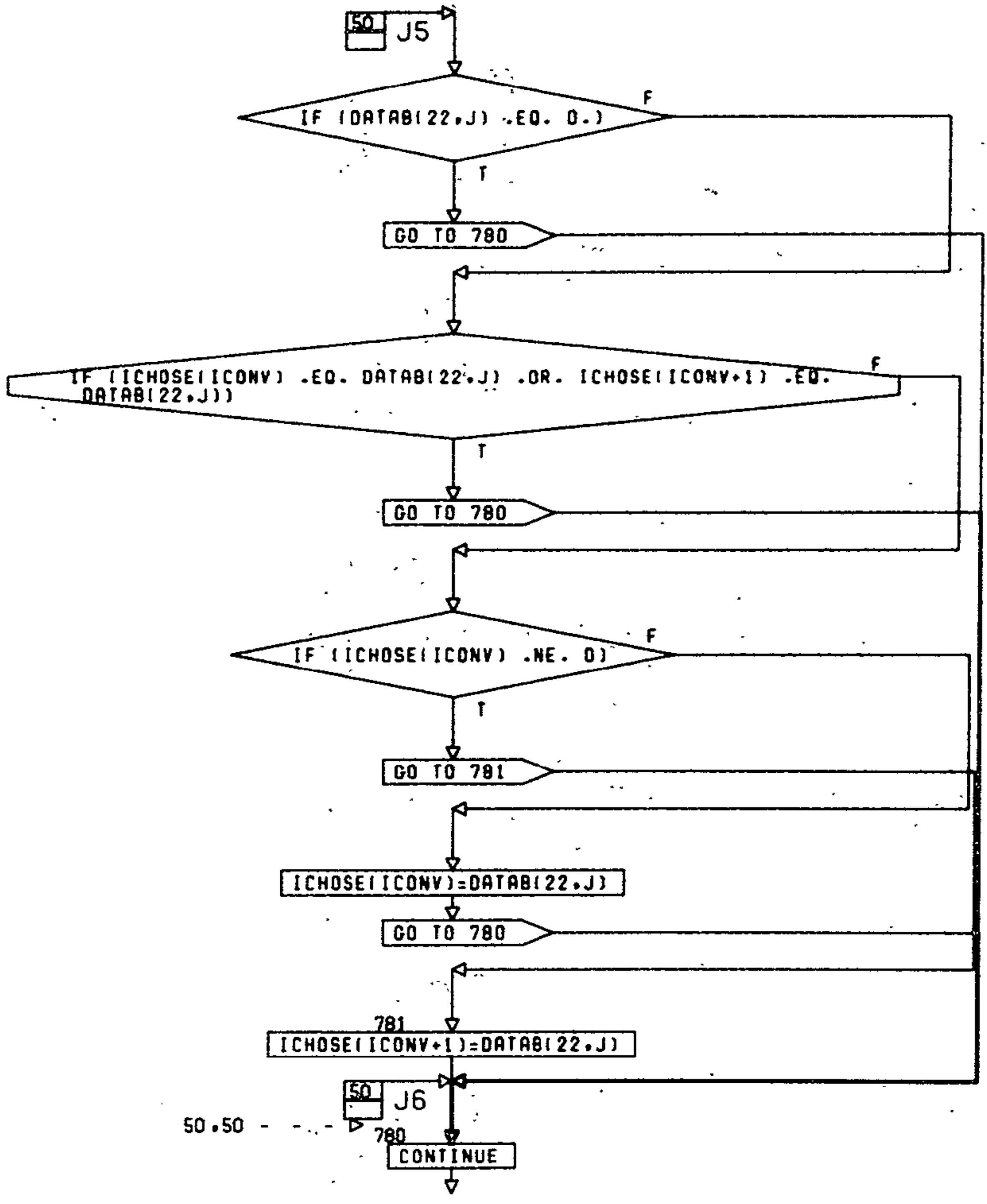
CONT. ON PG 49.


48
J3
DO 751 I=1,9
IF (KCHOSE(I).EQ.0)
F
T
GO TO 751
NCHOSE(I) = 1
751
CONTINUE
48
J4
752
CONTINUE
J=0
DO 753 I=1,9
IF (KCHOSE(I).EQ.0)
F
T
GO TO 753
J=J+1
ICHOSE(J)=KCHOSE(I)
753
CONTINUE

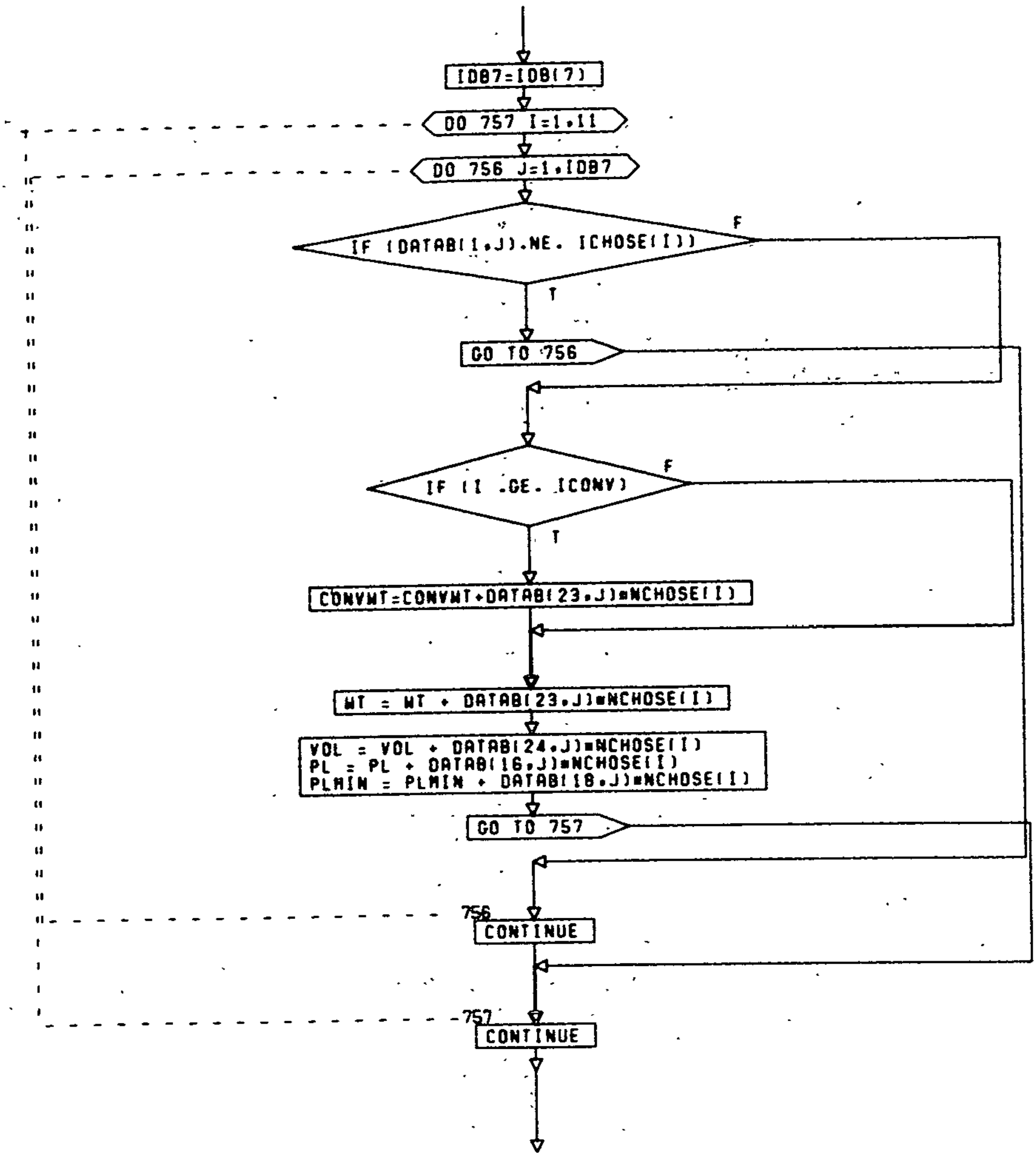
CONT. ON PG 50


ICONV=J+1
754
IF (J.EQ.11)
F
T
GO TO 755
J=J+1
ICHOSE(J)=0
GO TO 754
755
CONTINUE
ICHOSE(ICONV)=0
ICHOSE(ICONV+1)=0
IO86=IDB(6)
DO 780 I=1,9
51
DO 780 J=1,IO86
51
IF (DATAB(I,J) .NE. ICHOSE(I))
F
51
J5
T
GO TO 780
51
J6

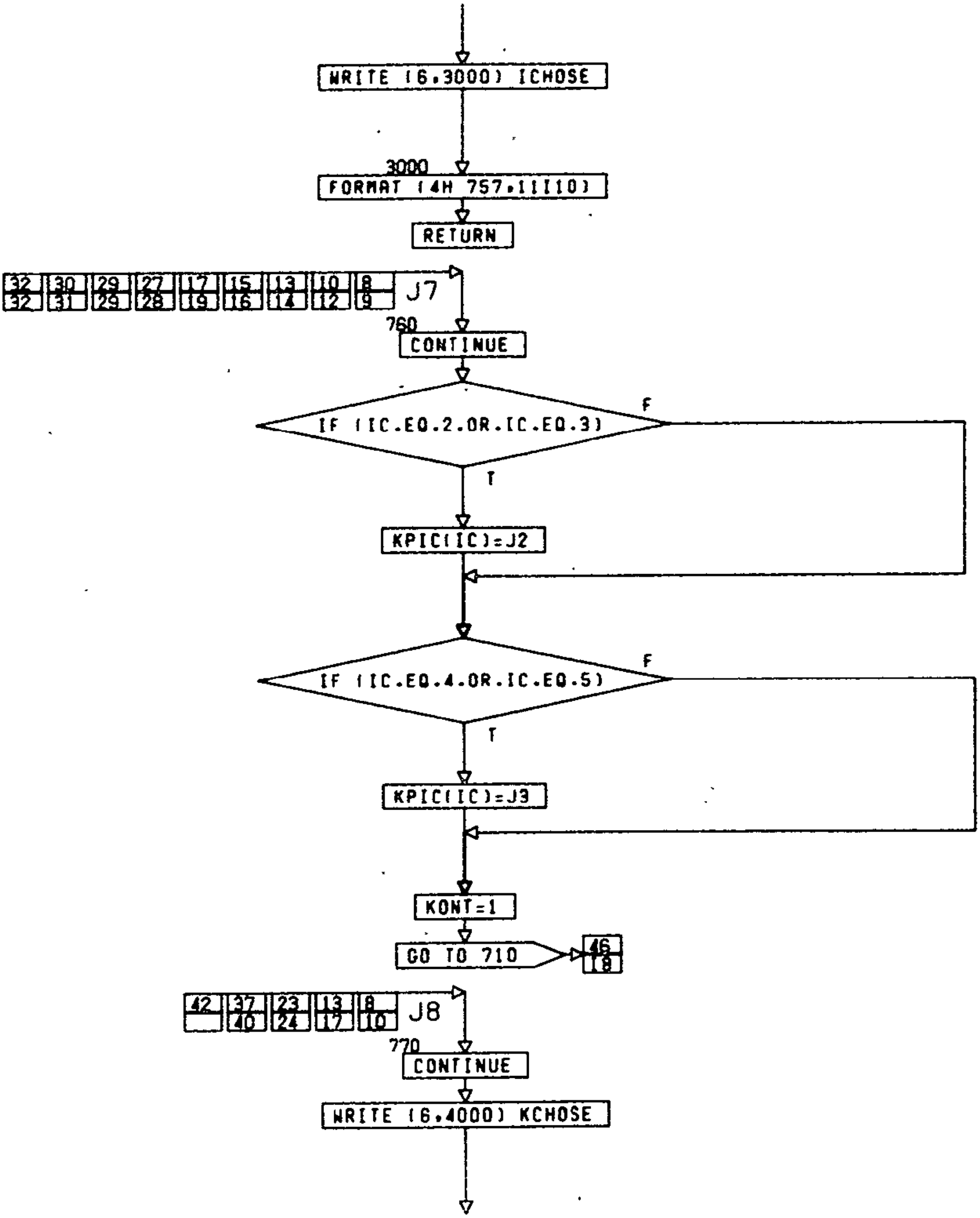
CONT. ON PG 51


50
J5
IF (DATAB(22,J) .EQ. 0.)
F
T
GO TO 780
IF (ICHOSE(ICONV) .EQ. DATAB(22,J) .OR. ICHOSE(ICONV+1) .EQ.
DATAB(22,J))
F
T
GO TO 780
IF (ICHOSE(ICONV) .NE. 0)
F
T
GO TO 781
ICHOSE(ICONV)=DATAB(22,J)
GO TO 780
781
ICHOSE(ICONV+1)=DATAB(22,J)
50
J6
50,50
780
CONTINUE

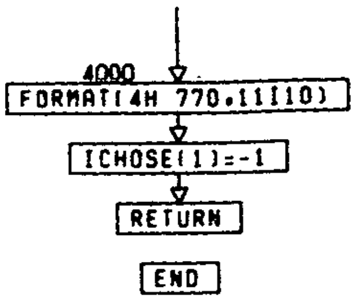
CONT. ON PG 52


IDB7=IDB(7)
DO 757 I=1,11
DO 756 J=1,IDB7
IF (DATAB(I,J).NE. ICHOSE(I))
F
T
GO TO 756
IF (I .GE. ICONV)
F
T
CONVWT=CONVWT+DATAB(23,J)*NCHOSE(I)
WT = WT + DATAB(23,J)*NCHOSE(I)
VOL = VOL + DATAB(24,J)*NCHOSE(I)
PL = PL + DATAB(16,J)*NCHOSE(I)
PLMIN = PLMIN + DATAB(18,J)*NCHOSE(I)
GO TO 757
756
CONTINUE
757
CONTINUE

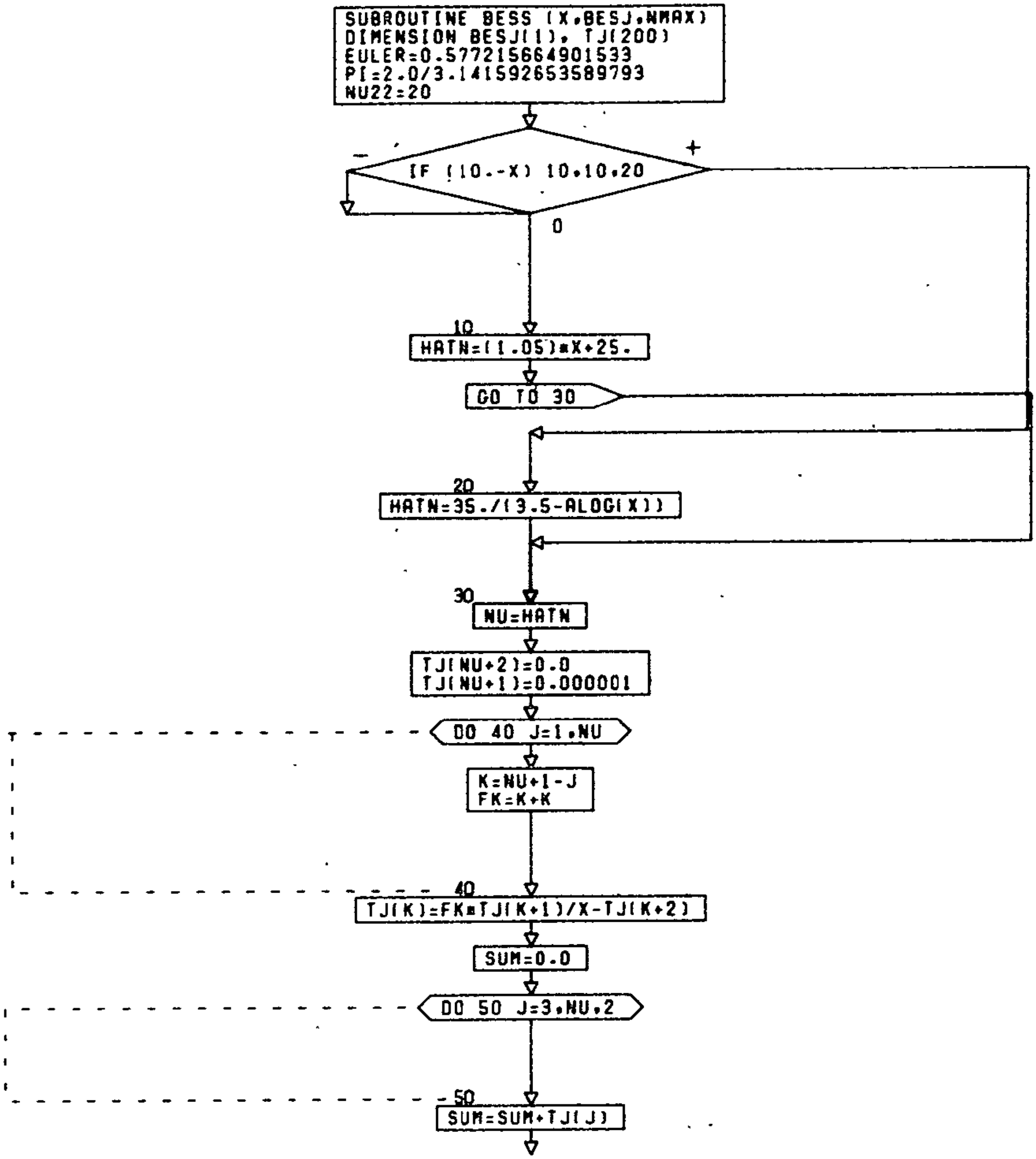
CONT. ON PG 53


WRITE (6,3000) ICHOSE
3000
FORMAT (4H 757,1I10)
RETURN
32 30 29 27 17 15 13 10 8
32 31 29 28 19 16 14 12 9
J7
760
CONTINUE
IF (IC.EQ.2.OR.IC.EQ.3)
F
T
KPIC(IC)=J2
IF (IC.EQ.4.OR.IC.EQ.5)
F
T
KPIC(IC)=J3
KONT=1
GO TO 710
46
18
42 37 23 13 8
40 24 17 10
J8
770
CONTINUE
WRITE (6,4000) KCHOSE

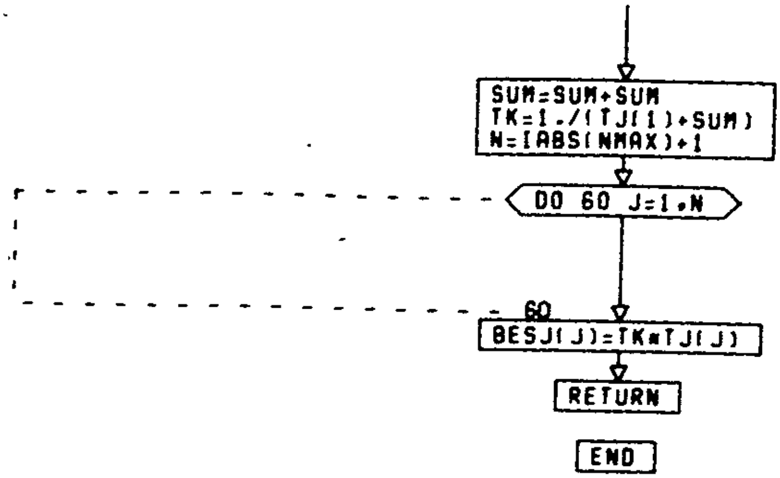
CONT. ON PG 54



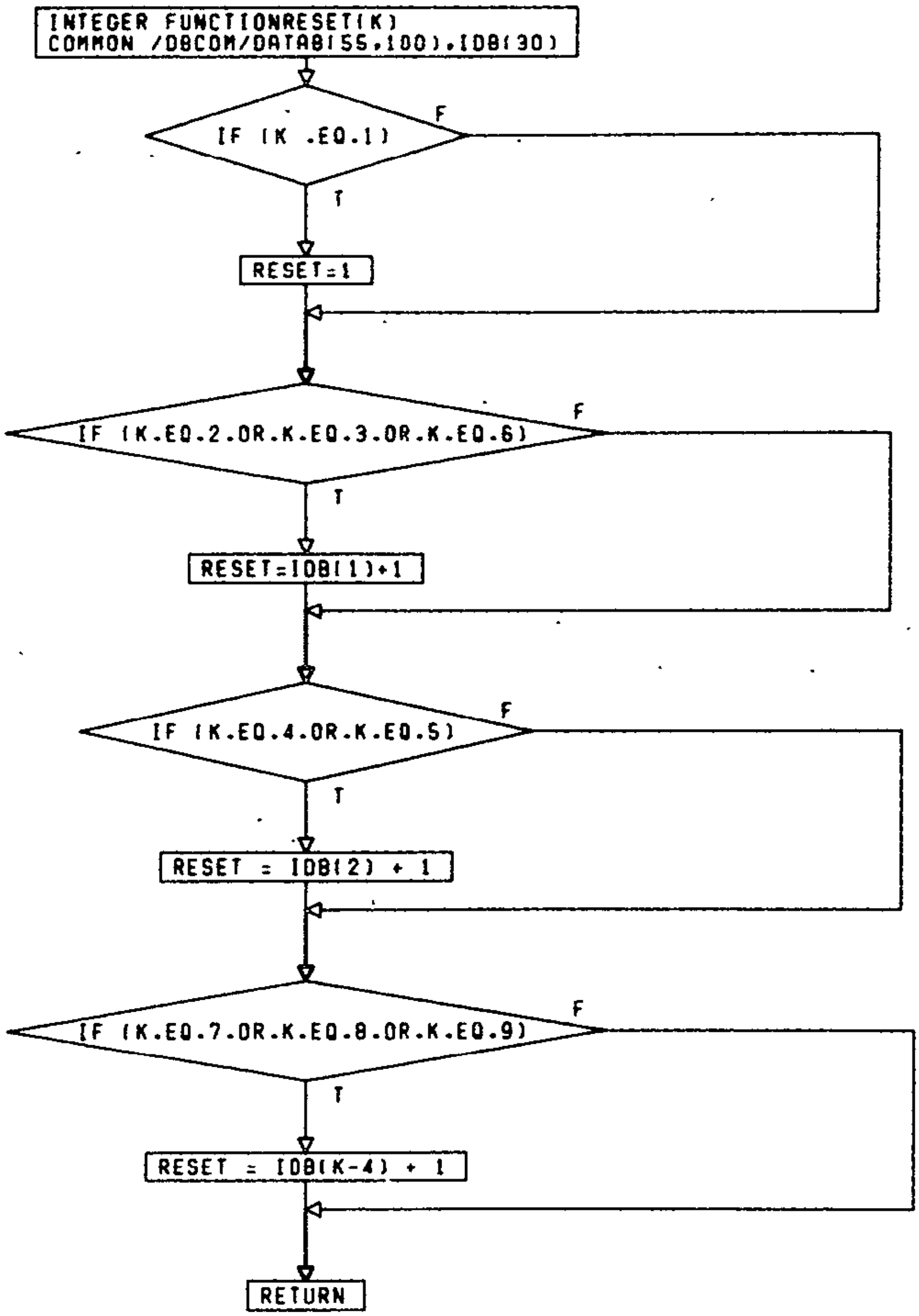
PG 54 FINAL


SUBROUTINE BESS (X,BESJ,NMAX)
DIMENSION BESJ(1), TJ(200)
EULER=0.577215664901533
PI=2.0/3.141592653589793
NU22=20
IF (10.-X) 10,10,20
-
+
0
10
HATN=(1.05)*X+25.
GO TO 30
20
HATN=35./(3.5-ALOG(X))
30
NU=HATN
TJ(NU+2)=0.0
TJ(NU+1)=0.000001
DO 40 J=1,NU
K=NU+1-J
FK=K+K
40
TJ(K)=FK*TJ(K+1)/X-TJ(K+2)
SUM=0.0
DO 50 J=3,NU,2
50
SUM=SUM+TJ(J)

CONT. ON PG 2


SUM=SUM+SUM
TK=1./(TJ(1)+SUM)
N=IABS(NMAX)+1
DO 60 J=1,N
60
BESJ(J)=TK*TJ(J)
RETURN
END

PG 2 FINAL


INTEGER FUNCTIONRESET(K)
COMMON /DBCOM/DATAB(55,100),IDB(30)
IF (K .EQ.1)
F
T
RESET=1
IF (K.EQ.2.OR.K.EQ.3.OR.K.EQ.6)
F
T
RESET=IDB(1)+1
IF (K.EQ.4.OR.K.EQ.5)
F
T
RESET = IDB(2) + 1
IF (K.EQ.7.OR.K.EQ.8.OR.K.EQ.9)
F
T
RESET = IDB(K-4) + 1
RETURN

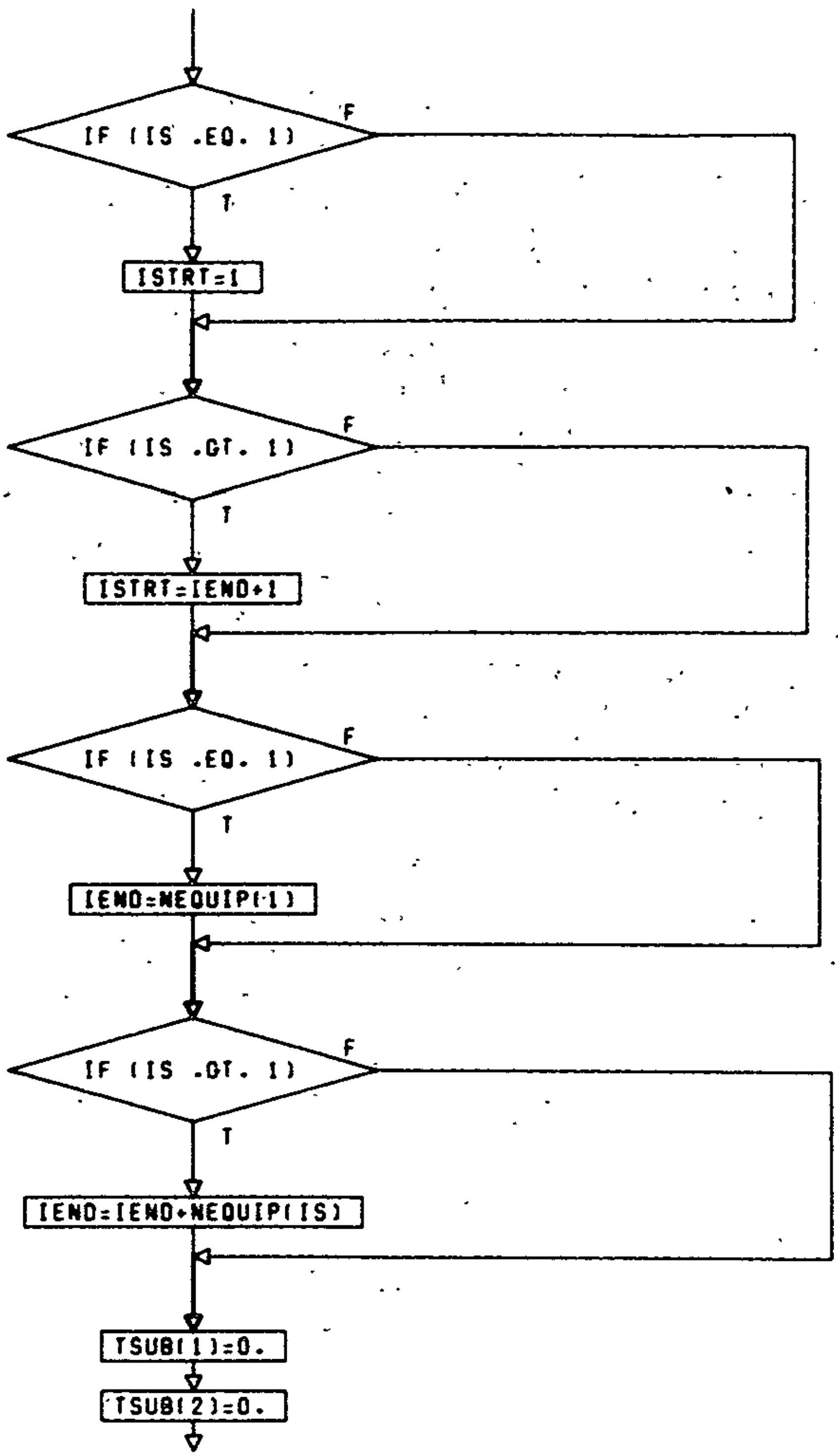
CONT. ON PG 2

END

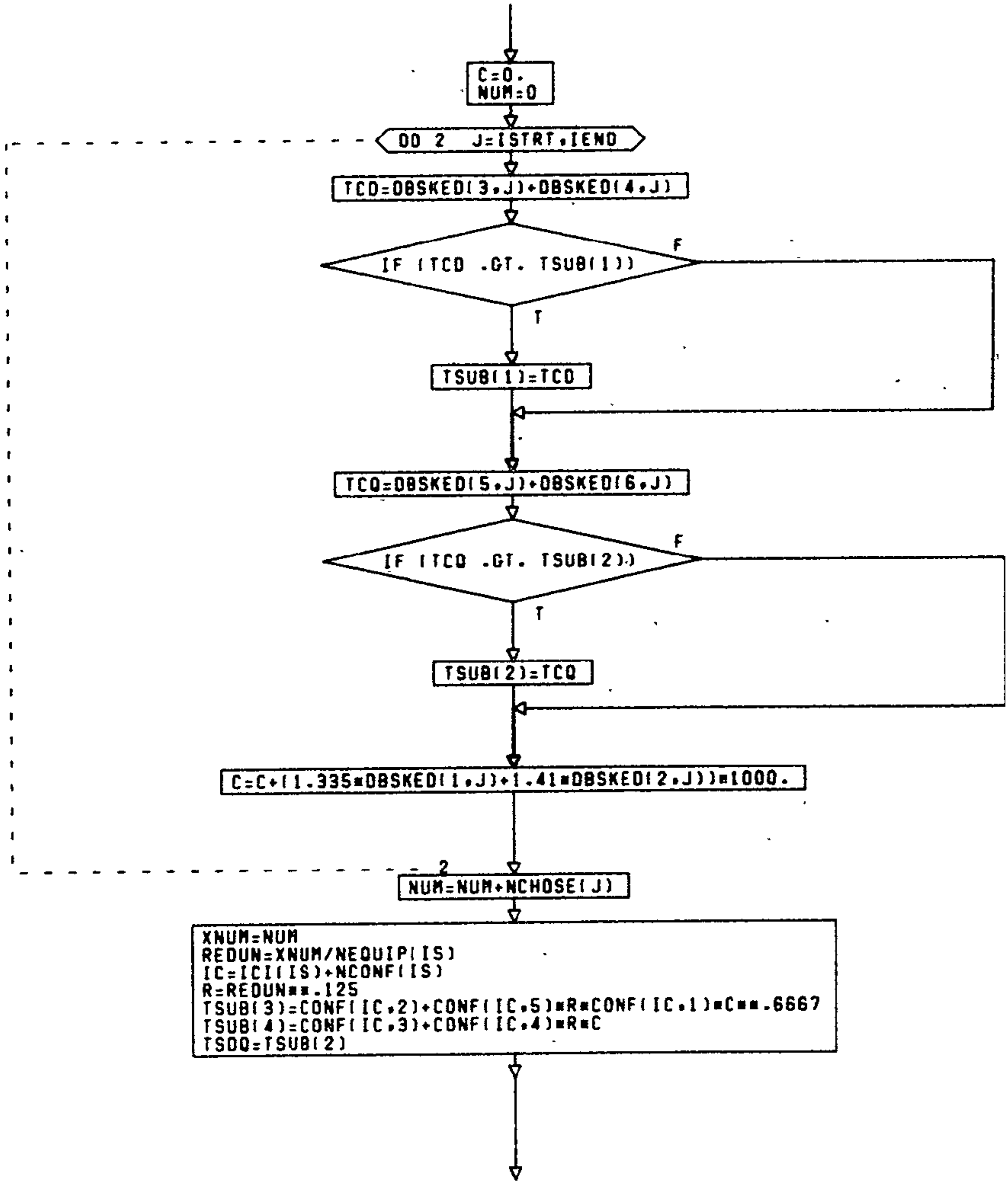
PG 2 FINAL

```
SUBROUTINE SKED(NEQUIP,NCONF)
COMMON /USER8/SKDME(7,3)

COMMON /CHOSE/     COST(5,60),      OPIA(11,60),    ICHOSE(60),
                   NCHOSE(60),      REL ( 6,60), DBSKED(7,60),
                   THM(4,60)

COMMON/PRTCOM/   ACCRCY,        AM,        AN,        BF,        BS,
                COPI(7,2),    CISTAR,      CTOT,      DOTE,        DE,
                   DRIWT,     EQBSTR,    FEEINV,    FEEOPS,      FEER,
                     GSE,       IREL,    ITRUNC,    MMDOLD,NAME(3,60),
                     OPS,     PAYINV,    PAYOUL,      PAYR,        PE,
                     PMP,        PMR, POWER(6),         PU,   PWR(60),
                     QCP,        QCR,  ROLD(60),    SABMWT,    SATADP,
                  SATINV,       SATR,      SEIP,      SEIR,  TSAVE(6),

                SSREL(6),    SUBE(7),   SUBT(7),  SUBUE(7),  SUBUP(7),
                      TA,  TAU(6,6),         TB,        TC,        TE,
                      TF,      TOOLR,     TOOLU,    TOTOPS,     TRUNC,
                      TS,       TTT,VOLUME(6),  VOL(60),WEIGHT(6),
                   XLTOT,       XMEH,    XMEINV,      XMEL,     XMEVL,
                    XMEW,      XMEWT,     XVEST

DIMENSION CONF(22,5),TSUB(6),ICI(5),NEQUIP(5),NCONF(6)
DATA ICI/0,5,8,10,15/

DATA CONF/1.,1.5,1.,2.,1.5,3*1.,2.,12*1.,2.,
  6.,9.,6.,12.,9.,5.,6.,8.,4.,6*2.,6*4.,2.,
  22*7.,22*2.E-7,5*.0001,3*.0002,13*.00007,.0002/

FK=1.

C       CONF ROWS ARE 1 TO 5 FOR S AND C
C                     6 TO 8 FOR AUXPRO
C                     9 TO 10 FOR OPI
C                      11 TO 15 FOR COMM
C                      16 TO 21 FOR EP
C                      22 FOR M E

DO 1 J=1,6
TAU(6,J) = 0.0
1 TSAVE(J)=0.
DO 4 IS=1,5  ---- ▷ 5
```

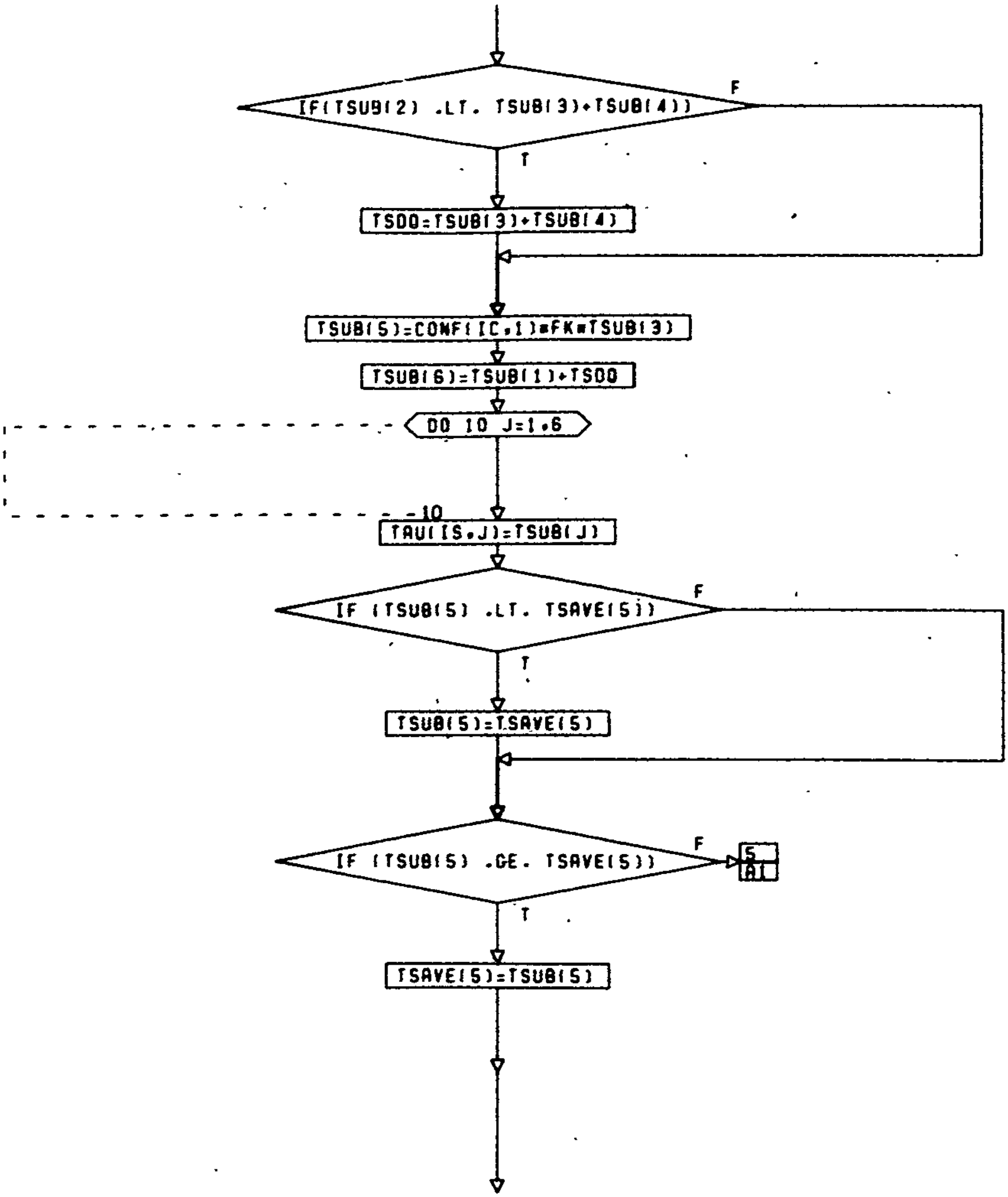
CONT. ON PG 2


IF (IS .EQ. 1)
F
T
ISTRT=1
IF (IS .GT. 1)
F
T
ISTRT=IEND+1
IF (IS .EQ. 1)
F
T
IEND=NEQUIP(1)
IF (IS .GT. 1)
F
T
IEND=IEND+NEQUIP(IS)
TSUB(1)=0.
TSUB(2)=0.

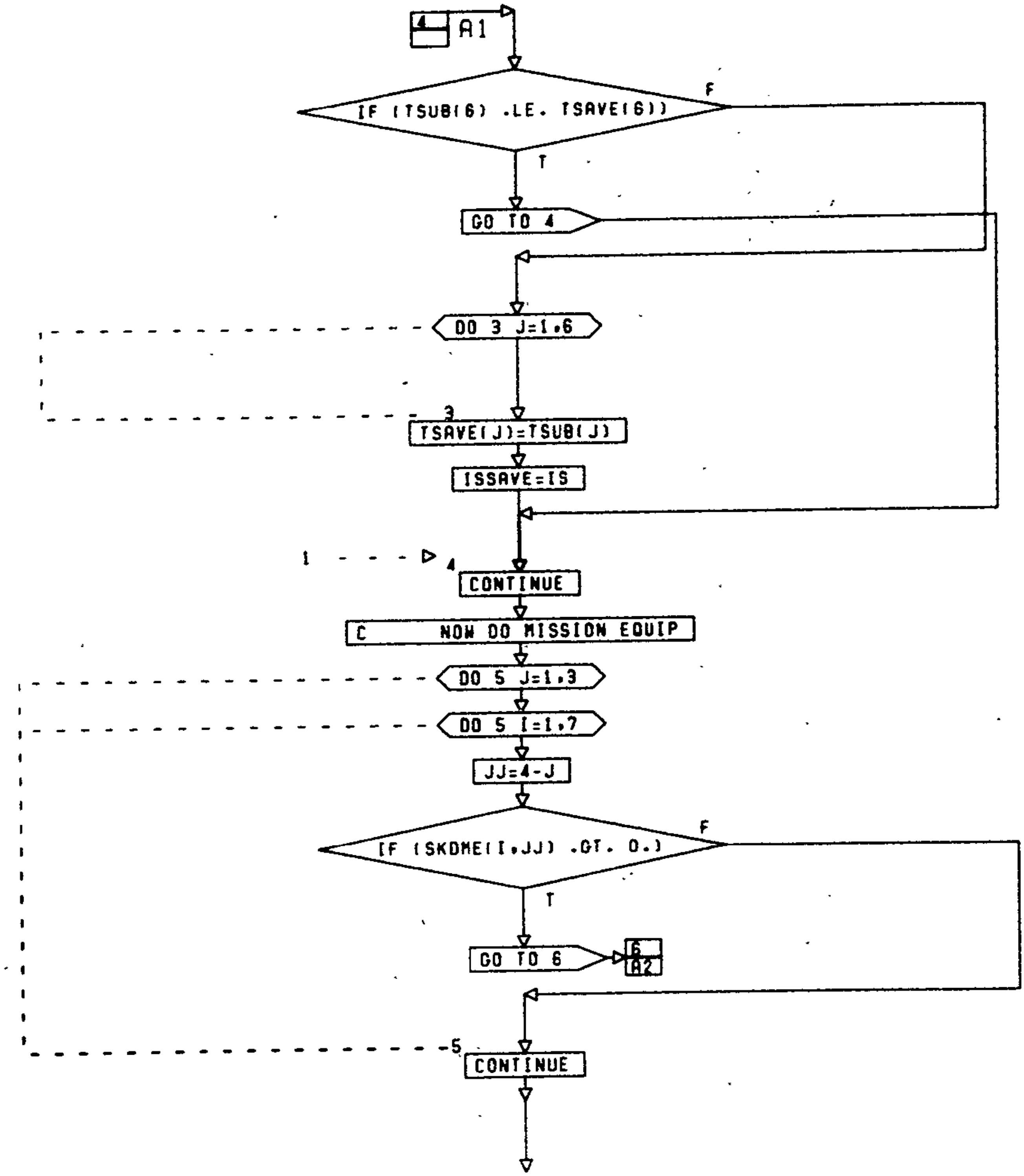
CONT. ON PG 3


C=0.
NUM=0
DO 2 J=ISTRT,IEND
TCD=OBSKED(3,J)+OBSKED(4,J)
IF (TCD .GT. TSUB(1))
F
T
TSUB(1)=TCD
TCQ=OBSKED(5,J)+OBSKED(6,J)
IF (TCQ .GT. TSUB(2))
F
T
TSUB(2)=TCQ
C=C+(1.335*OBSKED(1,J)+1.41*OBSKED(2,J))*1000.
2
NUM=NUM+NCHOSE(J)
XNUM=NUM
REDUN=XNUM/NEQUIP(IS)
IC=ICI(IS)+NCONF(IS)
R=REDUN**.125
TSUB(3)=CONF(IC,2)+CONF(IC,5)*R*CONF(IC,1)*C**.6667
TSUB(4)=CONF(IC,3)+CONF(IC,4)*R*C
TSDQ=TSUB(2)

CONT. ON PG 4

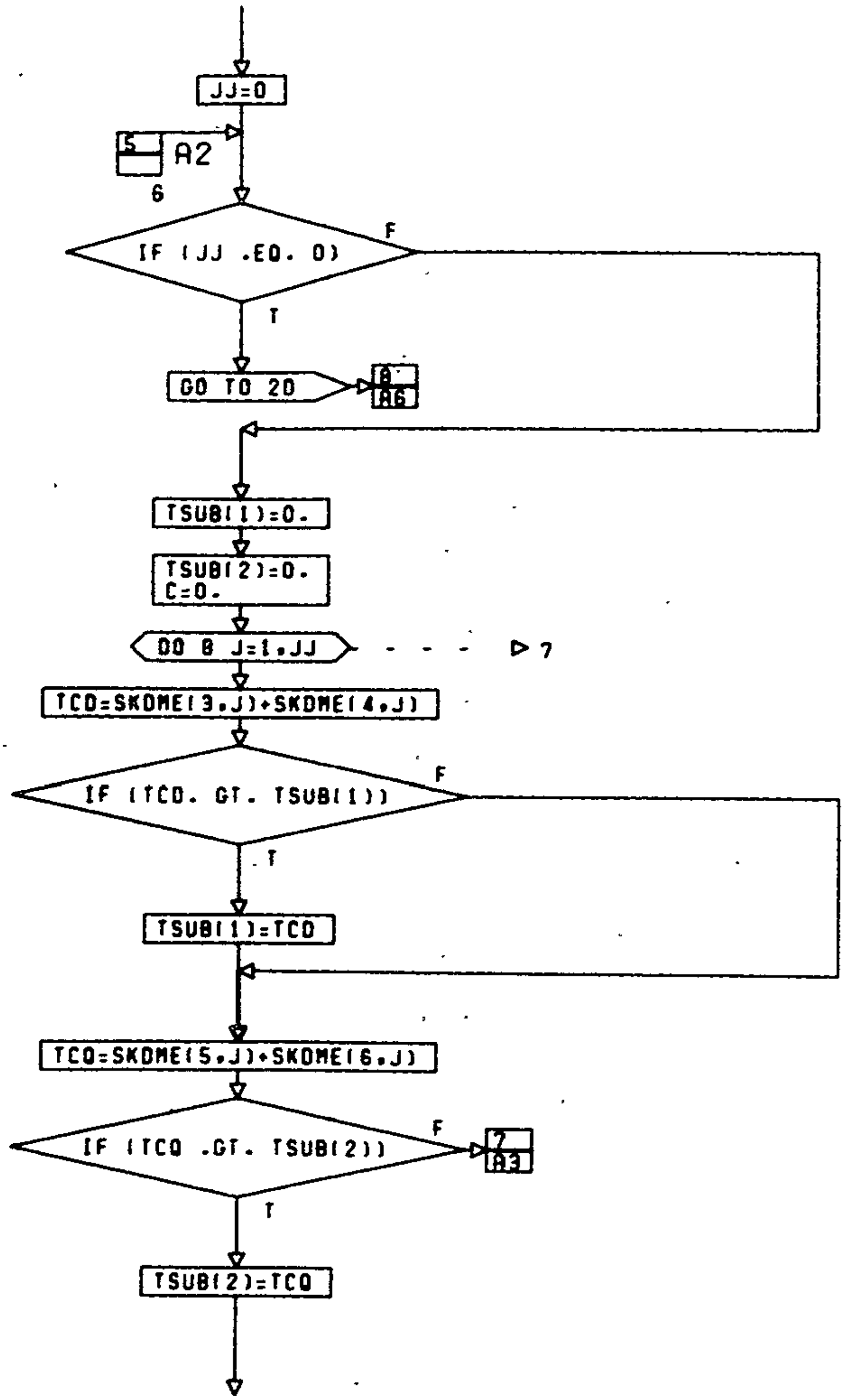

IF(TSUB(2) .LT. TSUB(3)+TSUB(4))
F
T
TSDO=TSUB(3)+TSUB(4)
TSUB(5)=CONF(IC,1)*FK*TSUB(3)
TSUB(6)=TSUB(1)+TSDO
DO 10 J=1,6
10
TAU(IS,J)=TSUB(J)
IF (TSUB(5) .LT. TSAVE(5))
F
T
TSUB(5)=TSAVE(5)
IF (TSUB(5) .GE. TSAVE(5))
F
5
A1
T
TSAVE(5)=TSUB(5)

CONT. ON PG 5

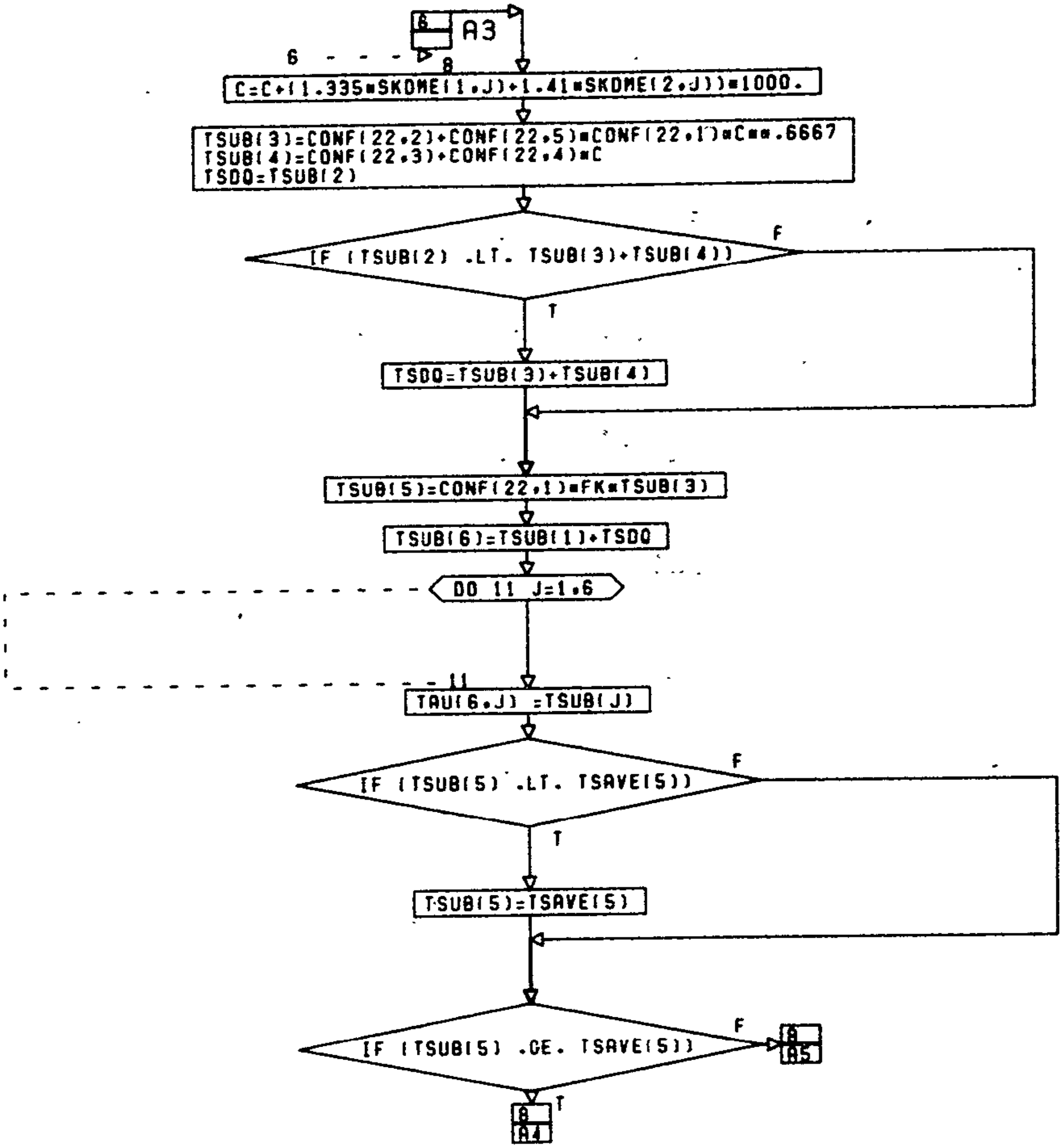


4
A1
IF (TSUB(6) .LE. TSAVE(6))
F
T
GO TO 4
DO 3 J=1,6
3
TSAVE(J)=TSUB(J)
ISSAVE=IS
1
4
CONTINUE
C NOW DO MISSION EQUIP
DO 5 J=1,3
DO 5 I=1,7
JJ=4-J
IF (SKDME(I,JJ) .GT. 0.)
F
T
GO TO 6
6
A2
5
CONTINUE

CONT. ON PG 6

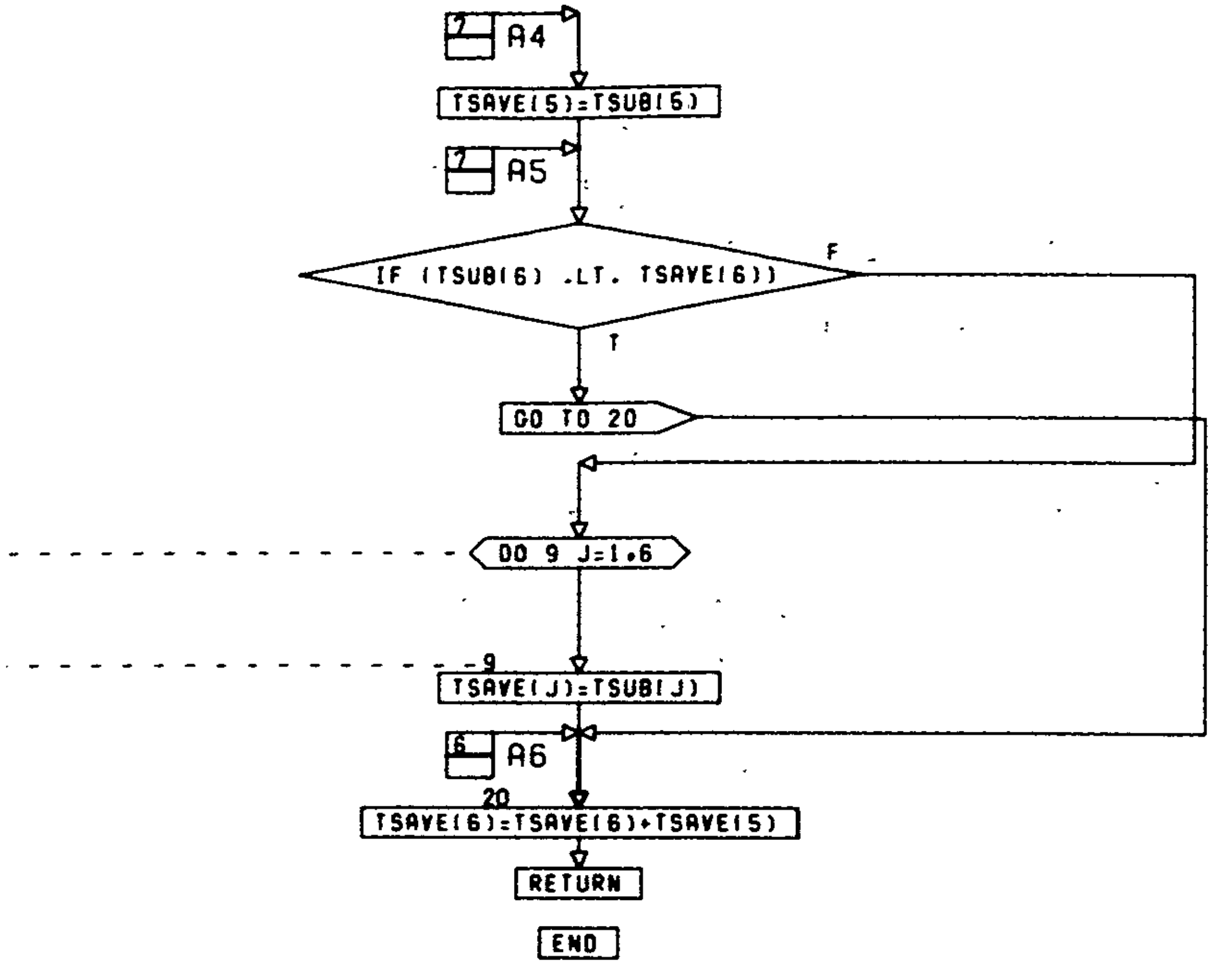

JJ=0
5
A2
6
IF (JJ .EQ. 0)
F
T
GO TO 20
8
A6
TSUB(1)=0.
TSUB(2)=0.
C=0.
DO 8 J=1,JJ
7
TCO=SKOME(3,J)+SKOME(4,J)
IF (TCO. GT. TSUB(1))
F
T
TSUB(1)=TCO
TCQ=SKOME(5,J)+SKOME(6,J)
IF (TCQ .GT. TSUB(2))
F
7
A3
T
TSUB(2)=TCQ

CONT. ON PG 7



6
A3
6
8
C=C+(1.335*SKDME(1,J)+1.41*SKDME(2,J))*1000.
TSUB(3)=CONF(22,2)+CONF(22,5)*CONF(22,1)*C**.6667
TSUB(4)=CONF(22,3)+CONF(22,4)*C
TSDQ=TSUB(2)
IF (TSUB(2) .LT. TSUB(3)+TSUB(4))
F
T
TSDQ=TSUB(3)+TSUB(4)
TSUB(5)=CONF(22,1)*FK*TSUB(3)
TSUB(6)=TSUB(1)+TSDQ
DO 11 J=1,6
11
TAU(6,J) =TSUB(J)
IF (TSUB(5) .LT. TSAVE(5))
F
T
TSUB(5)=TSAVE(5)
IF (TSUB(5) .GE. TSAVE(5))
F
8
A5
T
8
A4

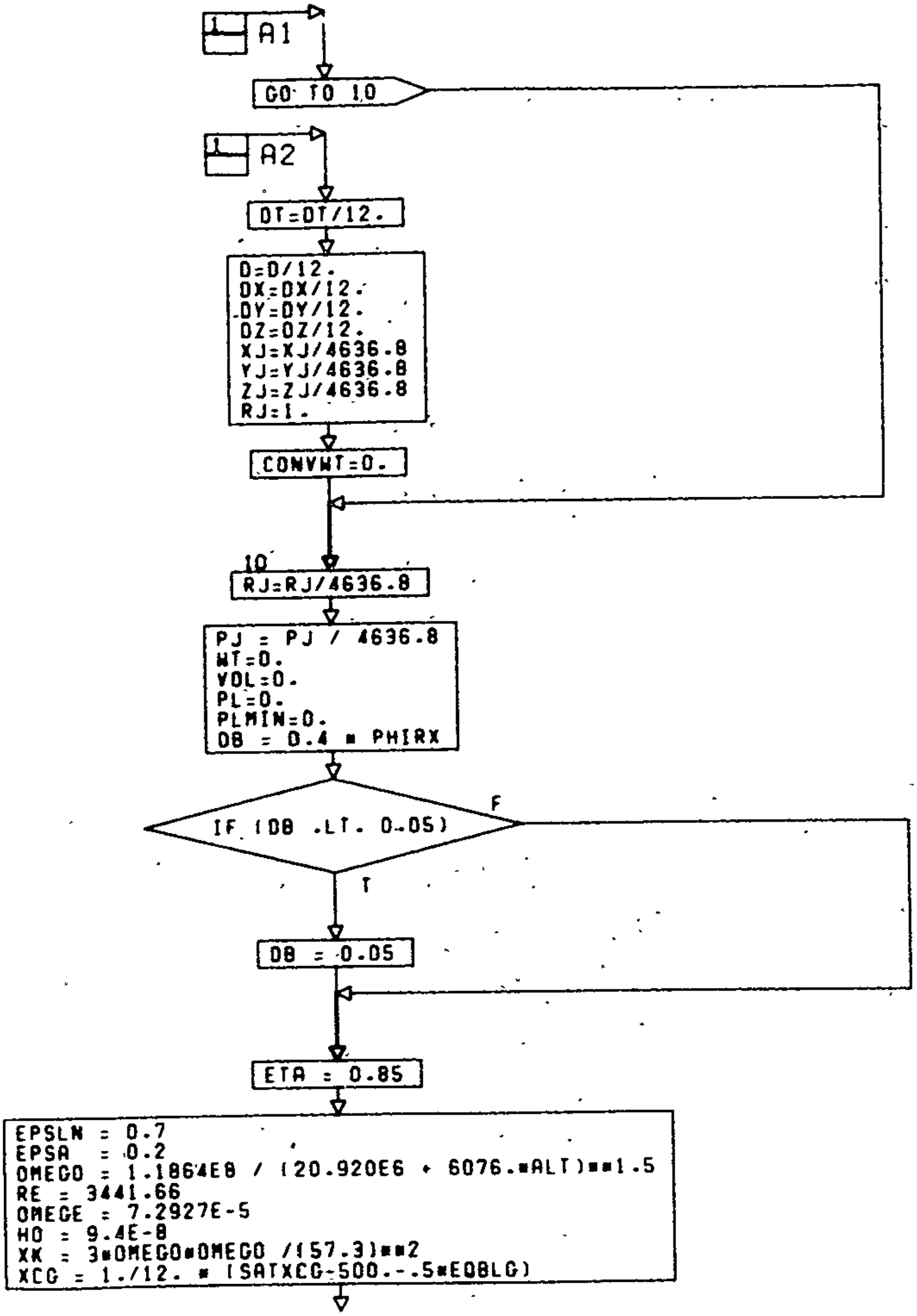
CONT. ON PG 8


7
A4
TSAVE(5)=TSUB(5)
7
A5
IF (TSUB(6) .LT. TSAVE(6))
F
T
GO TO 20
DO 9 J=1,6
9
TSAVE(J)=TSUB(J)
6
A6
20
TSAVE(6)=TSAVE(6)+TSAVE(5)
RETURN
END

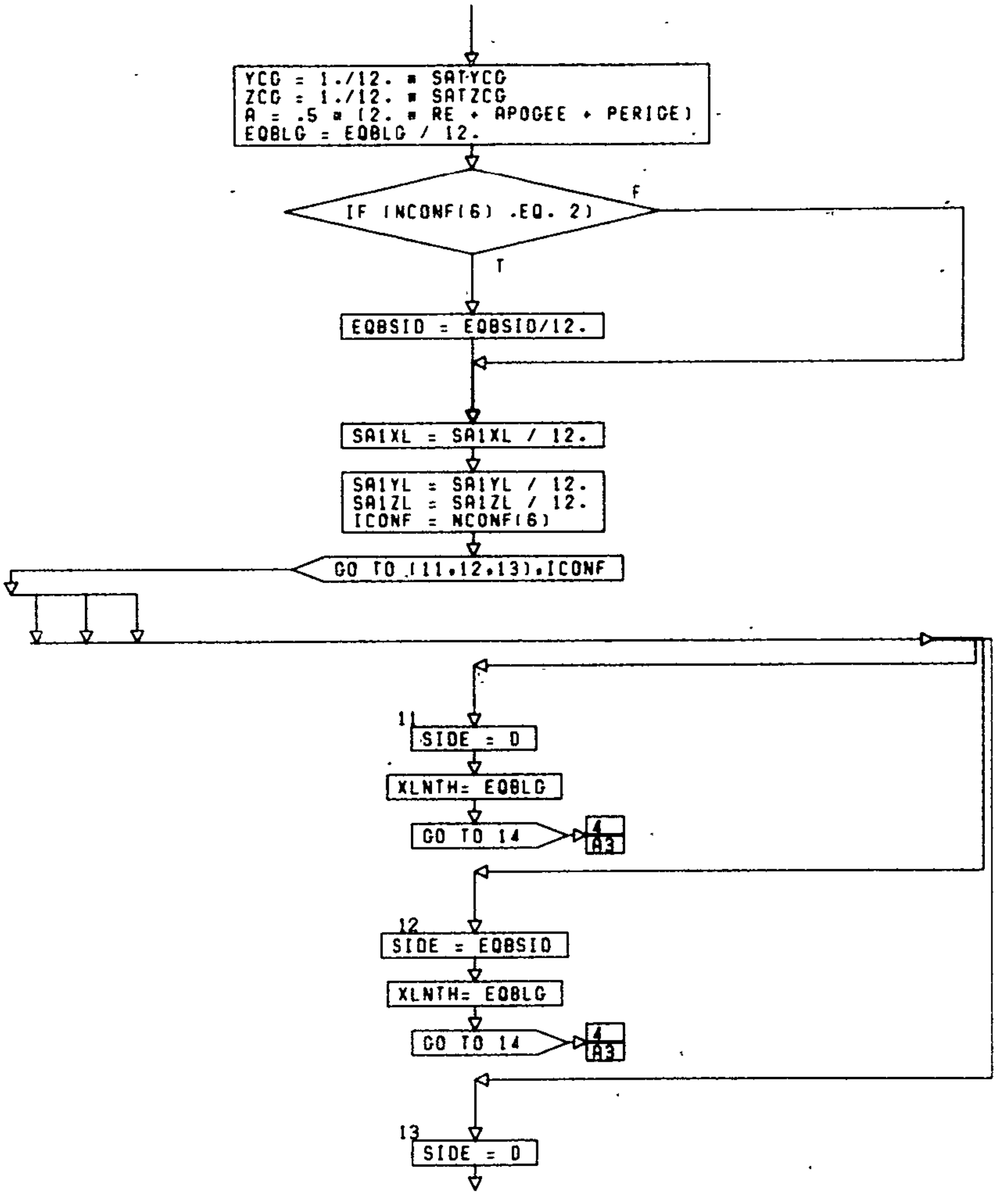
PG 8 FINAL

```
SUBROUTINE SANDC(IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)

C          ICHOSE(10) IS SELECTED EQUIP AS FOUR DIGIT EQUIP = -- MANF =
C          NCONF IS CONFIGURATION NUMBER,ITER IS NUMBER OF THIS ITERATION
C          IERR IS A MULTIPLE MESSAGE ERROR FLAG,IPIC IS THE LAST
C          SET OF SUBSCRIPTS CHOSEN
C          COMMON USER LISTS USER INPUT PARAMETERS
C          COMMON BTWN LISTS NECESSARY COMMUNICATION BETWEEN SUBROUTINES
C          COMMON CDATA HAS LAST SUBSCRIPT FOR EACH PIECE OF EQUIP,AND
C          THE NECESSARY PIECE OF THE DATA BASE

DIMENSION  ICHOSE(9),IPIC(3),ES(6),C(5),DMA(2),D(3),F(9),NCHOSE(9)
DIMENSION NCONF(6)

COMMON /USER1/    ALPHA,       AX,        AY,        AZ,       DPHI,
                     EA,     EANT,       EP1,         K,       MANV,
                  OMEGR,   PDOTAV,    PDOTRX,    PDOTRY,     PDOTRZ,
                 PDOTST,    PDOTX,     PDOTY,     PDOTZ,      PDOTO,
                 PHIFOV,    PHIRX,     PHIRY,     PHIRZ,     TACCEL,
                 THETMX,    THOLD,        TL,     TPMIN,     TSMALL,
                     XN,      XNN,      XNNN,       XNU,         YN,
                     ZN

COMMON /USERI/   APOGEE,   COMRAT,    DIAMAX, EEQWT(9),      EPME,
                 EQM1WT,   EQM1XL,    EQM1YL,    EQM1ZL,     EQM2WT,
                 EQM2XL,   EQM2YL,    EQM2ZL,        FE,     IAGNCY,
         IDEBUG,   ISAT,   MB12SH,    OPTEMP,    ORBINC,     PERIGE,
          MICRO,  RELME,  SPEC(6),     SPEC1,         T,     XCGSA1,
                   XMER,     XMEU

COMMON /BTWN/     ACSSN,    ACSWP,       ALT,      AREA,     BATCAP,
              BITRAT(2),    CLIFE,    CONVWT,         D,         DT,
                     DX,       DY,        DZ,     EQBLG,     EQBSID,
                     FC,       FF,    HARNWT,       HPT,     HTPIPE,
                   HTPT,   HTRPRB,    HTRPWR,                IBTLOC,
                  LMBDO,       NC,     OMEGS,    PASSTR,         PJ,
                     PL,    PLMIN,    POCNWT,      RADA,      RADAB,
                    RAT,       RJ,    SABOLG,     SATLG,     SATTWT,

                  SATWT,   SATXCG,    SATYCG,    SATZCG,     SA1XL,
                  SA1YL,    SA1ZL,      SIDE,     SYSLB,     THCMWT,
              THRUST(2),       TI,     TNKWT,     TPRIM,         VB,
                   VCHP,      VOL,      WATE,        WB,        WBT,
                     WT,       XJ,    XNZERO,        YJ,         ZJ

COMMON /DBCOM/DATAB(55,100),IDB(30)
DATA XMD,YMD,ZMD,DI,XMD2,YMD2,ZMD2/3*.0003,.03,3*.04/
ACSSN=2.

IF (NCONF(1) .EQ. 1)   F -> 2/A2
                       T -> 2/A1
```

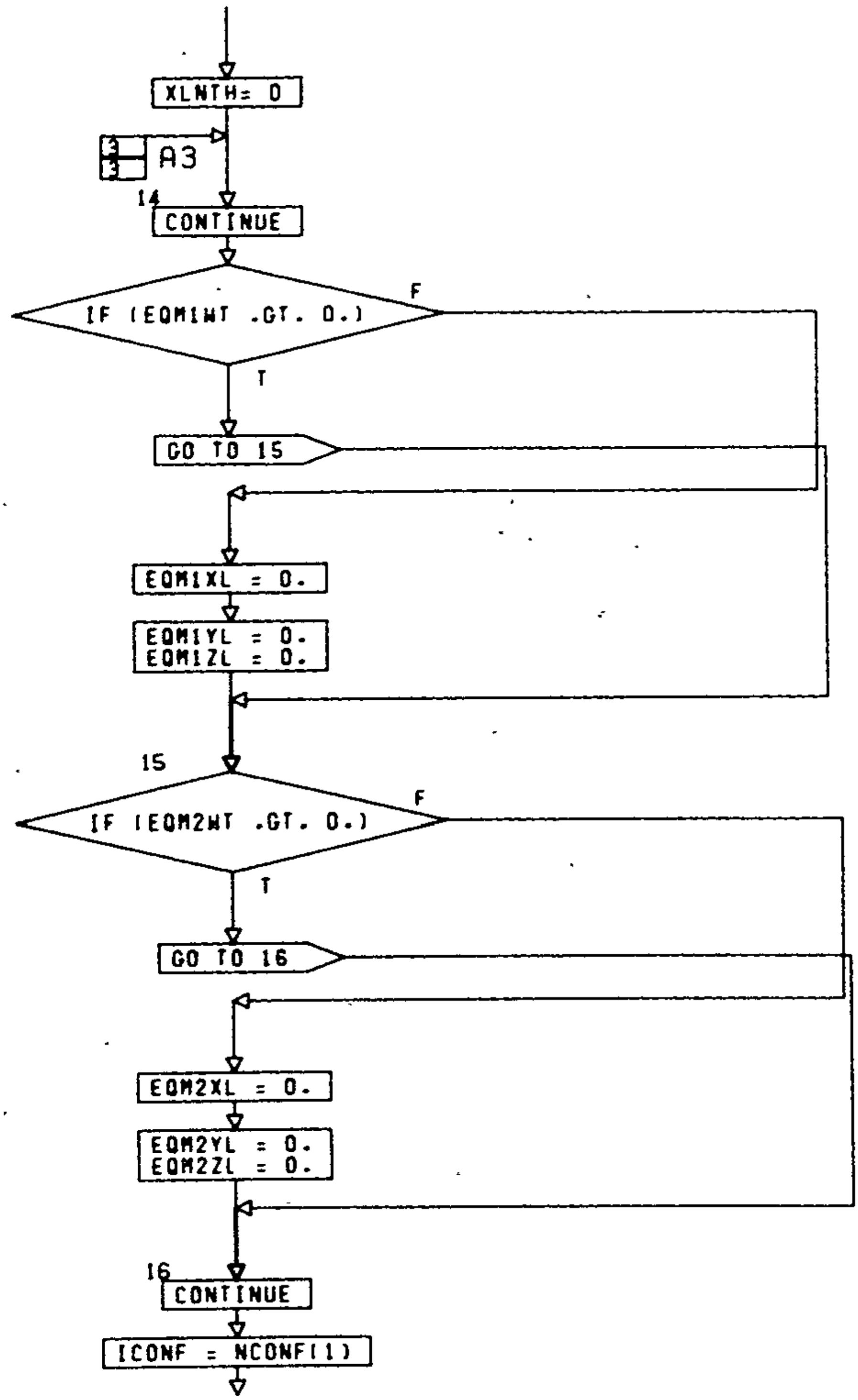
CONT. ON PG 2


A1
GO TO 10
A2
DT=DT/12.
D=D/12.
DX=DX/12.
DY=DY/12.
DZ=DZ/12.
XJ=XJ/4636.8
YJ=YJ/4636.8
ZJ=ZJ/4636.8
RJ=1.
CONVWT=0.
10
RJ=RJ/4636.8
PJ = PJ / 4636.8
WT=0.
VOL=0.
PL=0.
PLMIN=0.
DB = 0.4 * PHIRX
IF (DB .LT. 0.05)
F
T
DB = 0.05
ETA = 0.85
EPSLN = 0.7
EPSA = 0.2
OMEGO = 1.1864E8 / (20.920E6 + 6076.*ALT)**1.5
RE = 3441.66
OMEGE = 7.2927E-5
HO = 9.4E-8
XK = 3*OMEGO*OMEGO /(57.3)**2
XCG = 1./12. * (SATXCG-500.-.5*EQBLG)

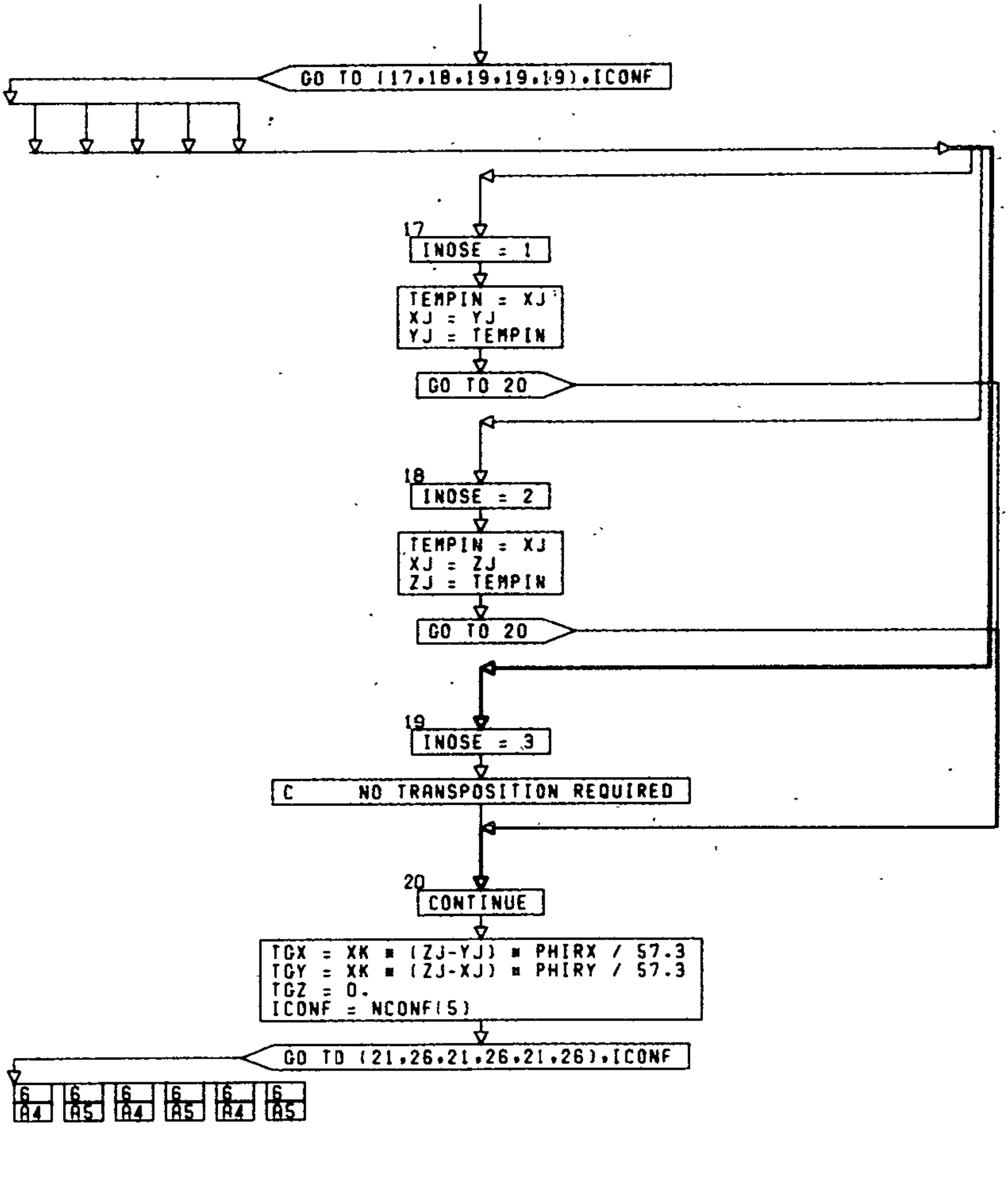
CONT. ON PG


YCG = 1./12. * SATYCG
ZCG = 1./12. * SATZCG
A = .5 * (2. * RE + APOGEE + PERIGE)
EQBLG = EQBLG / 12.
IF (NCONF(6) .EQ. 2)
F
T
EQBSID = EQBSID/12.
SA1XL = SA1XL / 12.
SA1YL = SA1YL / 12.
SA1ZL = SA1ZL / 12.
ICONF = NCONF(6)
GO TO (11,12,13),ICONF
11
SIDE = 0
XLNTH= EQBLG
GO TO 14
4
A3
12
SIDE = EQBSID
XLNTH= EQBLG
GO TO 14
4
A3
13
SIDE = 0

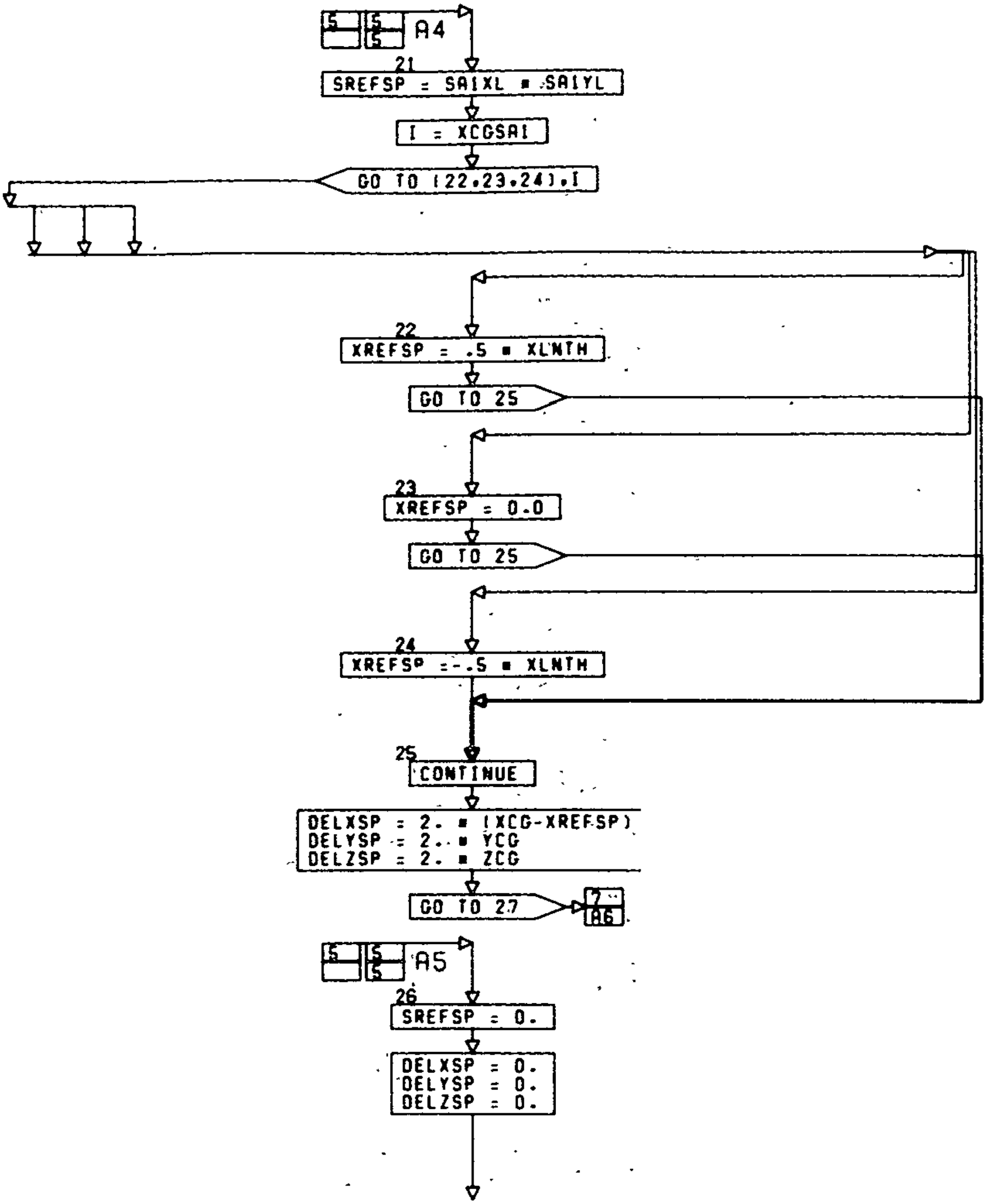
CONT. ON PG 4


XLNTH= 0
A3
14
CONTINUE
IF (EQM1WT .GT. 0.)
F
T
GO TO 15
EQM1XL = 0.
EQM1YL = 0.
EQM1ZL = 0.
15
IF (EQM2WT .GT. 0.)
F
T
GO TO 16
EQM2XL = 0.
EQM2YL = 0.
EQM2ZL = 0.
16
CONTINUE
ICONF = NCONF(1)

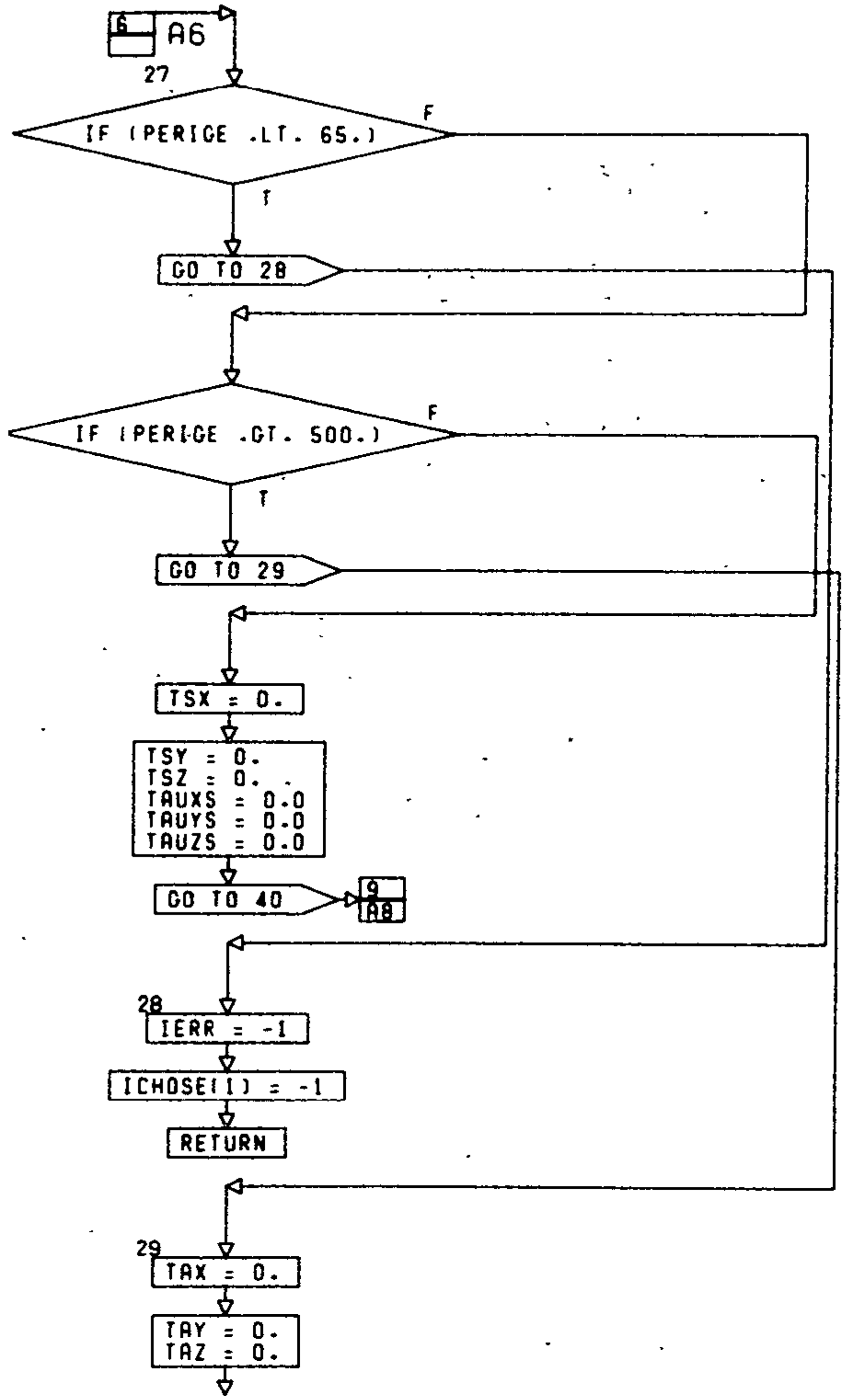
CONT. ON PG 5


GO TO (17,18,19,19,19),ICONF
17
INOSE = 1
TEMPIN = XJ
XJ = YJ
YJ = TEMPIN
GO TO 20
18
INOSE = 2
TEMPIN = XJ
XJ = ZJ
ZJ = TEMPIN
GO TO 20
19
INOSE = 3
C NO TRANSPOSITION REQUIRED
20
CONTINUE
TGX = XK * (ZJ-YJ) * PHIRX / 57.3
TGY = XK * (ZJ-XJ) * PHIRY / 57.3
TGZ = 0.
ICONF = NCONF(5)
GO TO (21,26,21,26,21,26),ICONF
6
A4
6
A5
6
A4
6
A5
6
A4
6
A5

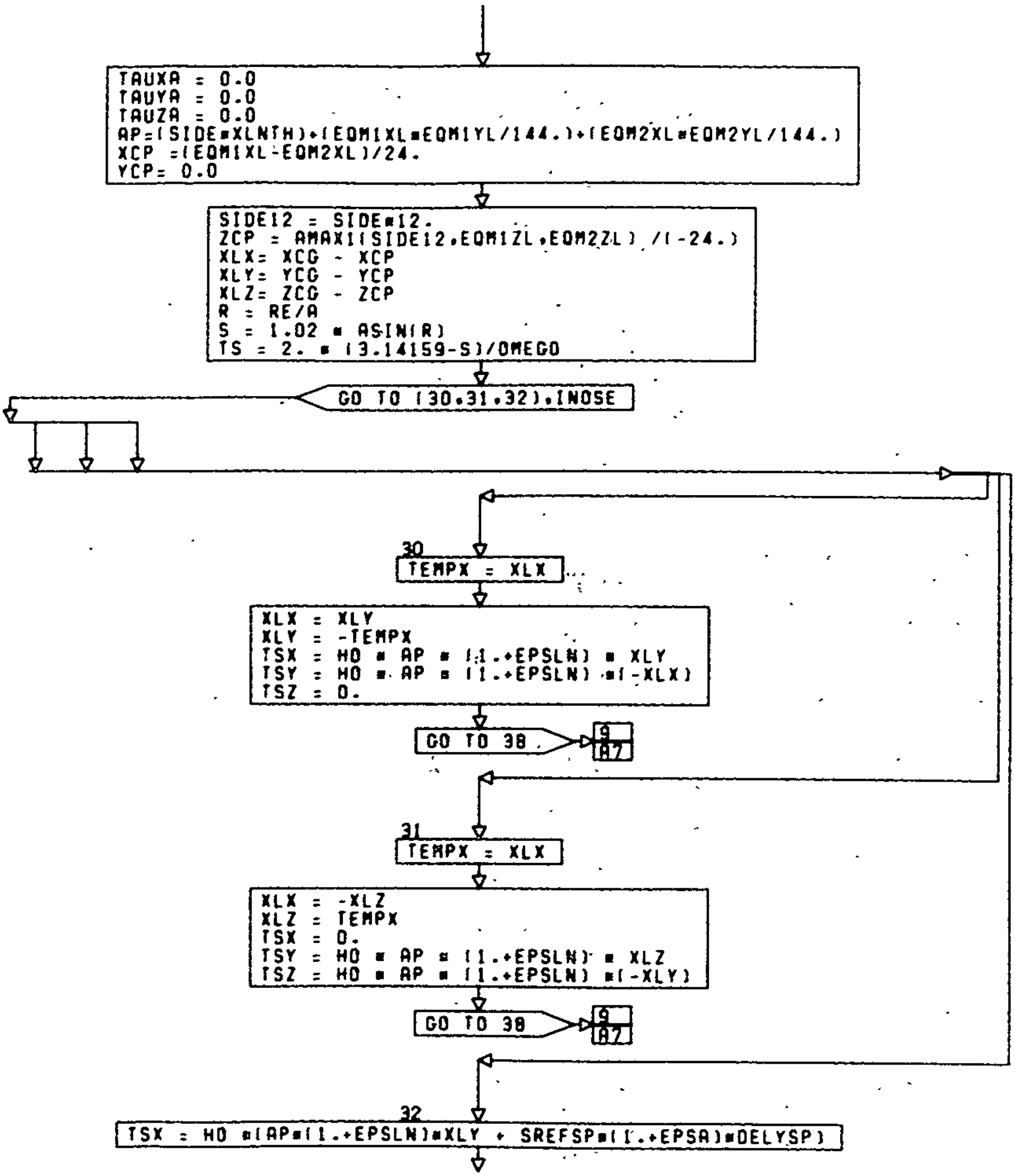
CONT. ON PG 6


5
5
5
A4
21
SREFSP = SAIXL * SAIYL
I = XCGSAI
GO TO (22,23,24),I
22
XREFSP = .5 * XLNTH
GO TO 25
23
XREFSP = 0.0
GO TO 25
24
XREFSP = -.5 * XLNTH
25
CONTINUE
DELXSP = 2. * (XCG-XREFSP)
DELYSP = 2. * YCG
DELZSP = 2. * ZCG
GO TO 27
7
A6
5
5
5
A5
26
SREFSP = 0.
DELXSP = 0.
DELYSP = 0.
DELZSP = 0.

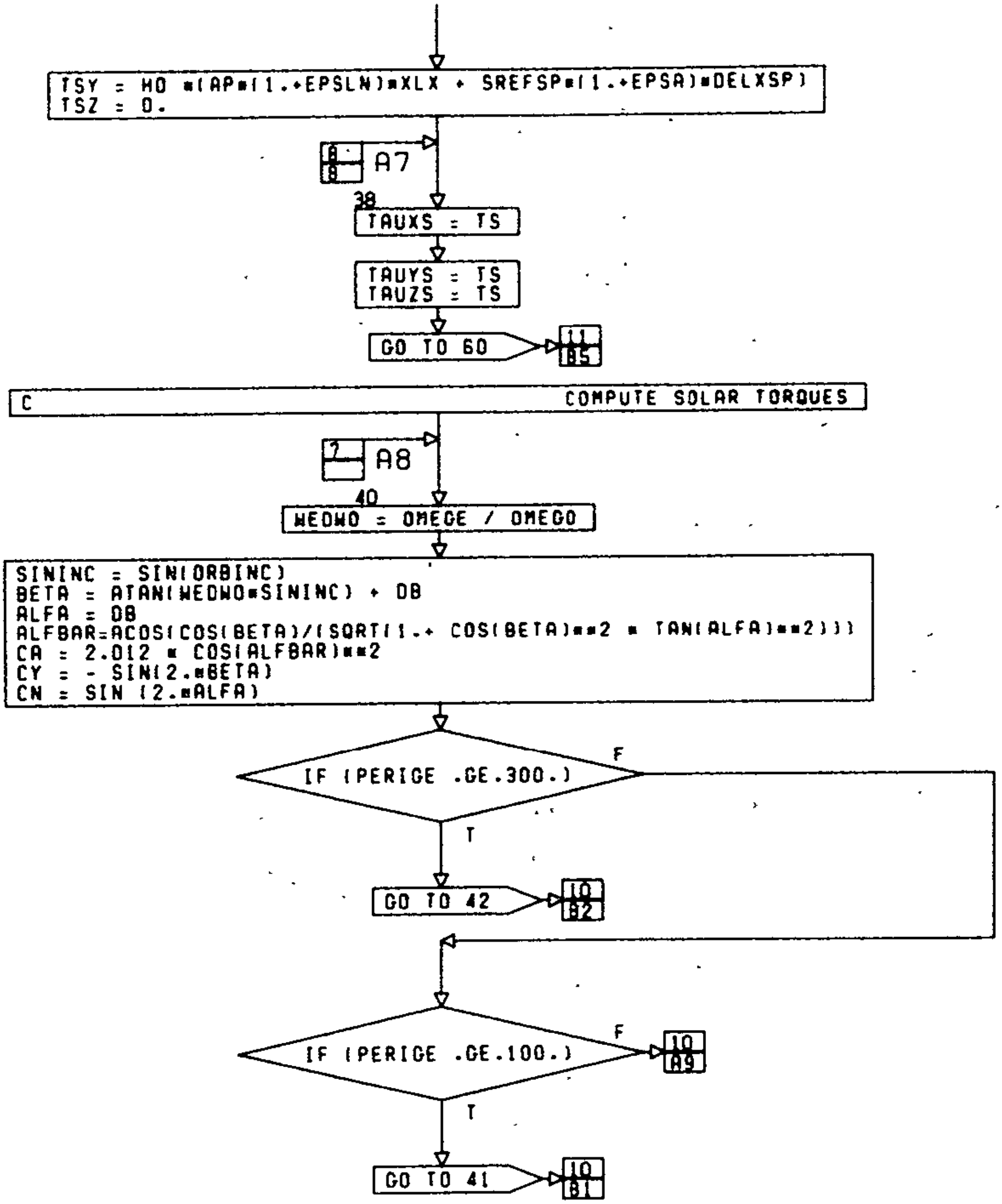
CONT. ON PG 7


6
A6
27
IF (PERIGE .LT. 65.)
F
T
GO TO 28
IF (PERIGE .GT. 500.)
F
T
GO TO 29
TSX = 0.
TSY = 0.
TSZ = 0.
TAUXS = 0.0
TAUYS = 0.0
TAUZS = 0.0
GO TO 40
9
A8
28
IERR = -1
ICHOSE(1) = -1
RETURN
29
TAX = 0.
TAY = 0.
TAZ = 0.

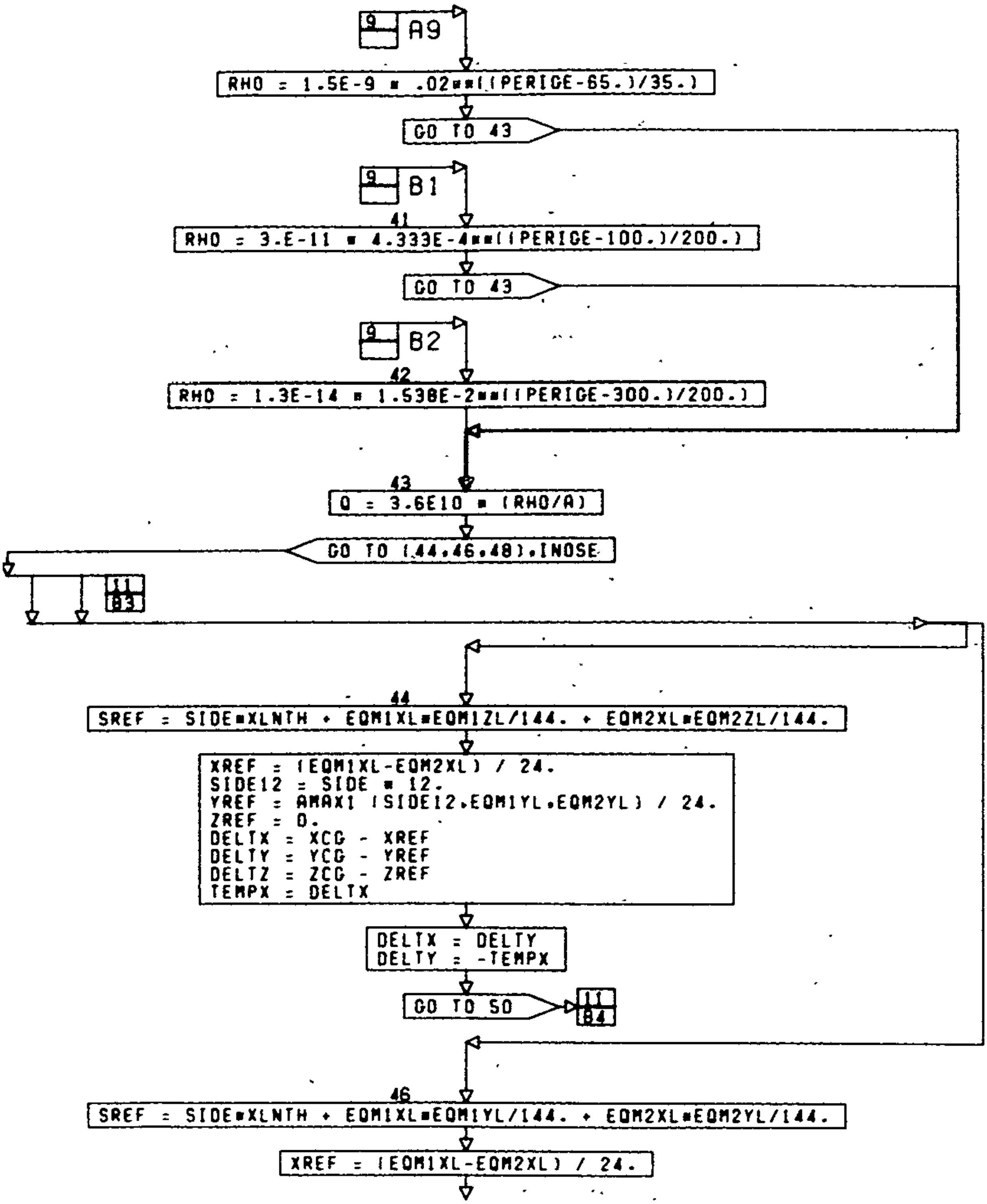
CONT. ON PG 8


TAUXA = 0.0
TAUYA = 0.0
TAUZA = 0.0
AP=(SIDE*XLNTH)+(EQM1XL*EQM1YL/144.)+(EQM2XL*EQM2YL/144.)
XCP =(EQM1XL-EQM2XL)/24.
YCP= 0.0
SIDE12 = SIDE*12.
ZCP = AMAX1(SIDE12,EQM1ZL,EQM2ZL) /(-24.)
XLX= XCG - XCP
XLY= YCG - YCP
XLZ= ZCG - ZCP
R = RE/A
S = 1.02 * ASIN(R)
TS = 2. * (3.14159-S)/OMEGO
GO TO (30,31,32),INOSE
30
TEMPX = XLX
XLX = XLY
XLY = -TEMPX
TSX = HO * AP * (1.+EPSLN) * XLY
TSY = HO * AP * (1.+EPSLN) *(-XLX)
TSZ = 0.
GO TO 38
9
A7
31
TEMPX = XLX
XLX = -XLZ
XLZ = TEMPX
TSX = 0.
TSY = HO * AP * (1.+EPSLN) * XLZ
TSZ = HO * AP * (1.+EPSLN) *(-XLY)
GO TO 38
9
A7
32
TSX = HO *(AP*(1.+EPSLN)*XLY + SREFSP*(1.+EPSA)*DELYSP)

CONT. ON PG 9


TSY = HO *(AP*(1.+EPSLN)*XLX + SREFSP*(1.+EPSA)*DELXSP)
TSZ = 0.
A7
38
TAUXS = TS
TAUYS = TS
TAUZS = TS
GO TO 60
11
B5
C
COMPUTE SOLAR TORQUES
7
A8
40
WEDWO = OMEGE / OMEGO
SININC = SIN(ORBINC)
BETA = ATAN(WEDWO*SININC) + DB
ALFA = DB
ALFBAR=ACOS(COS(BETA)/(SQRT(1.+ COS(BETA)**2 * TAN(ALFA)**2)))
CA = 2.D12 * COS(ALFBAR)**2
CY = - SIN(2.*BETA)
CN = SIN (2.*ALFA)
IF (PERIGE .GE.300.)
F
T
GO TO 42
10
B2
IF (PERIGE .GE.100.)
F
10
A9
T
GO TO 41
10
B1

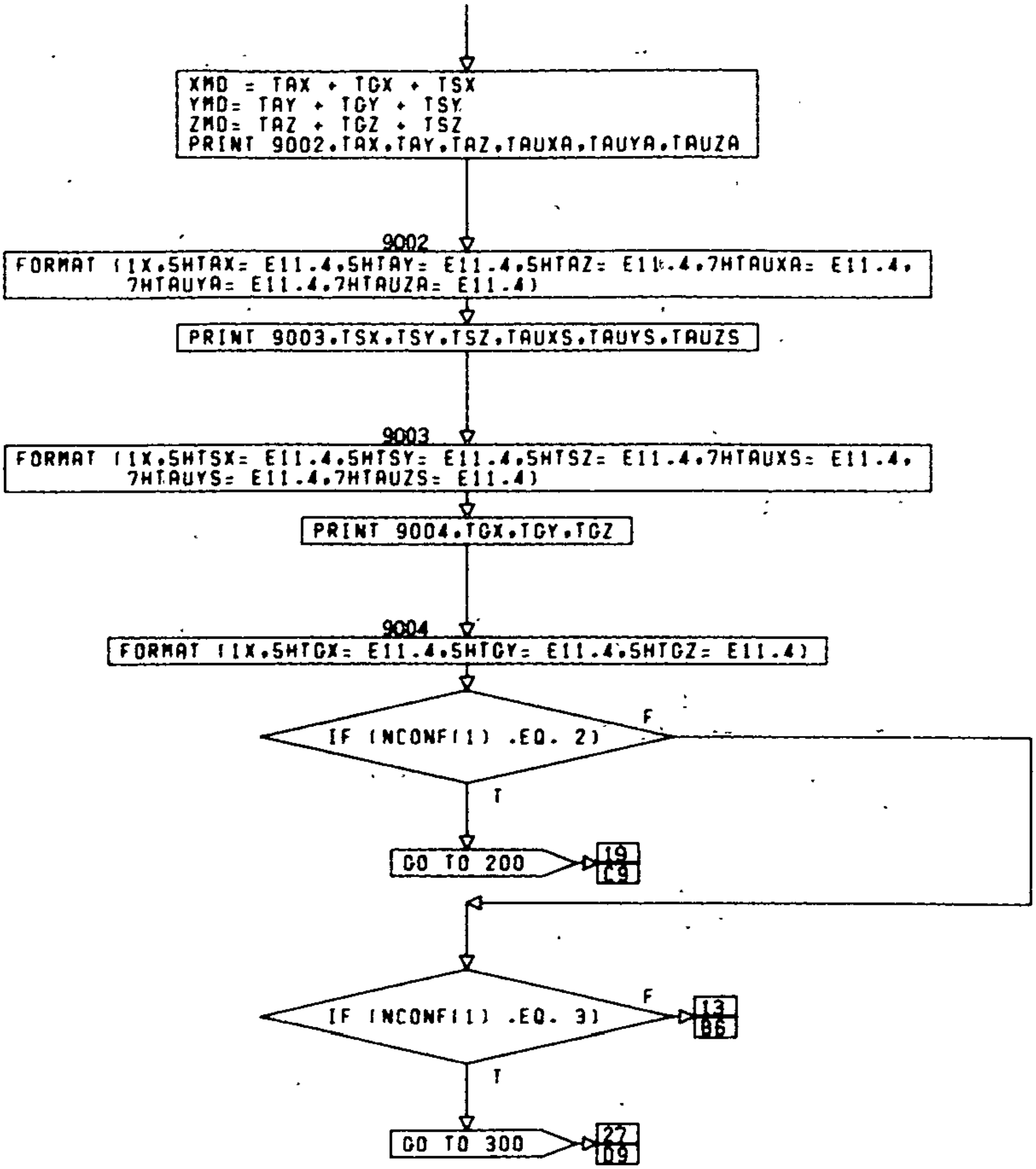
CONT. ON PG 10


9
A9
RHO = 1.5E-9 * .02**((PERIGE-65.)/35.)
GO TO 43
9
B1
41
RHO = 3.E-11 * 4.333E-4**((PERIGE-100.)/200.)
GO TO 43
9
B2
42
RHO = 1.3E-14 * 1.538E-2**((PERIGE-300.)/200.)
43
Q = 3.6E10 * (RHO/A)
GO TO (44,46,48),INOSE
11
B3
44
SREF = SIDE*XLNTH + EQM1XL*EQM1ZL/144. + EQM2XL*EQM2ZL/144.
XREF = (EQM1XL-EQM2XL) / 24.
SIDE12 = SIDE * 12.
YREF = AMAX1 (SIDE12,EQM1YL,EQM2YL) / 24.
ZREF = 0.
DELTX = XCG - XREF
DELTY = YCG - YREF
DELTZ = ZCG - ZREF
TEMPX = DELTX
DELTX = DELTY
DELTY = -TEMPX
GO TO 50
11
B4
46
SREF = SIDE*XLNTH + EQM1XL*EQM1YL/144. + EQM2XL*EQM2YL/144.
XREF = (EQM1XL-EQM2XL) / 24.

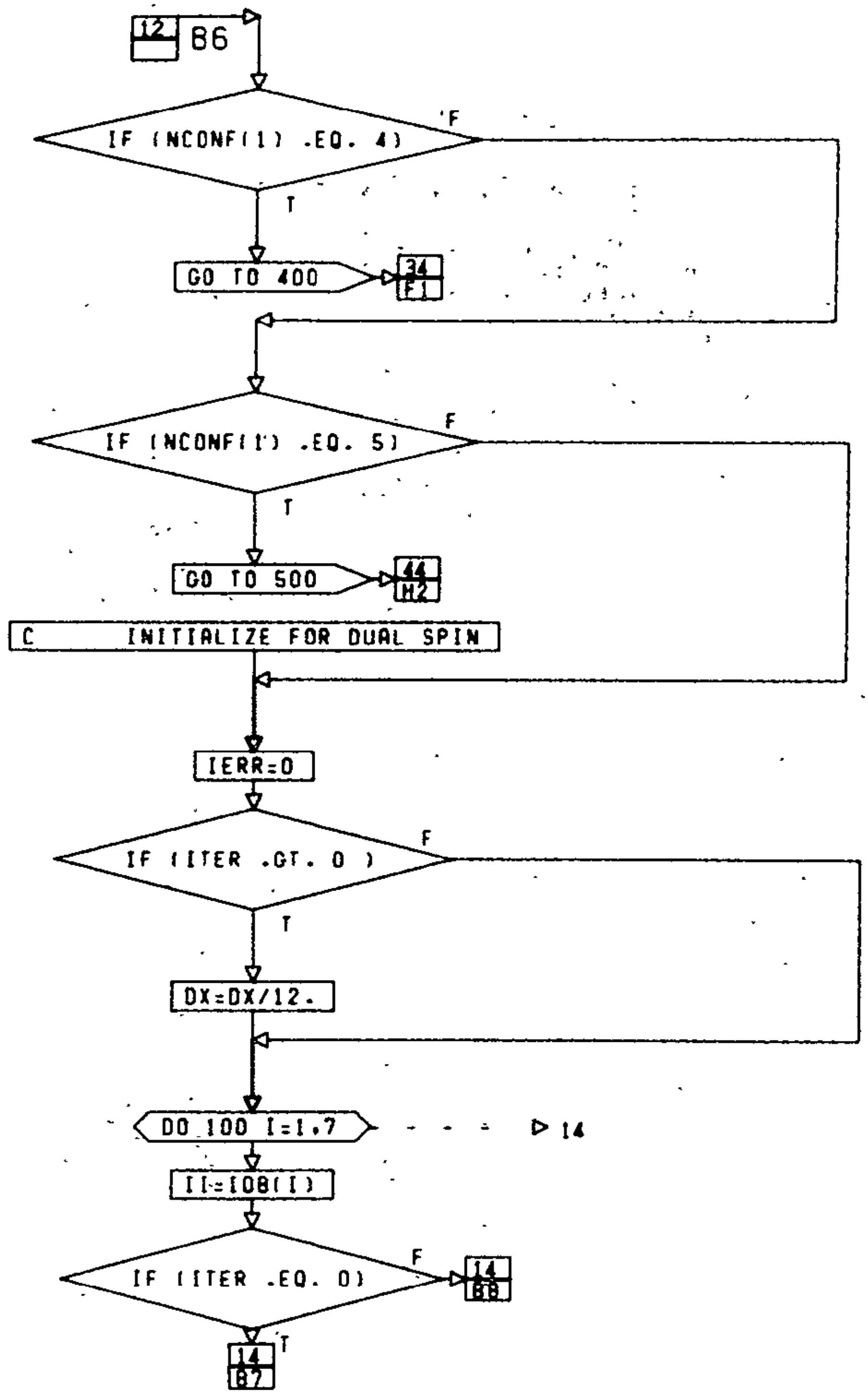
CONT. ON PG 11

```
YREF = 0.
SIDE12 = SIDE * 12.
ZREF = AMAX1 (SIDE12,EQM1ZL,EQM2ZL) /(-24.)
DELTX = XCG - XREF
DELTY = YCG - YREF
DELTZ = ZCG - ZREF
TEMPX = DELTX

DELTX = -DELTZ
DELTZ = TEMPX

GO TO 50

10 B3
48
SIDE12 = SIDE * 12.

SREF=AMAX1(SIDE12,EQM1YL,EQM2YL)*AMAX1(SIDE12,EQM1ZL,EQM2ZL)/144.
XREF = XLNTH/2. + EQM1XL/12.
YREF = 0.
ZREF = 0.
DELTX = XCG - XREF
DELTY = YCG - YREF
DELTZ = ZCG - ZREF

10 B4
50
TAX =Q*SREF*(DELTZ*CY+DELTY*CN)+Q*SREFSP*(DELZSP*CY+DELYSP*CN)

TAY =Q*SREF*(DELTZ*CA-DELTX*CN)+Q*SREFSP*(DELZSP*CA-DELXSP*CN)
TAZ =Q*SREF*(-DELTY*CA-DELTX*CY)+Q*SREFSP*(-DELYSP*CA-DELXSP*CY)
P = 17.8 /(APOGEE-PERIGE+18.75) +0.05
TAUXA = P * T * 2.592E6
TAUYA = P * T * 2.592E6
TAUZA = P * T * 2.592E6

9 B5
60
TAX = ABS (TAX)

TAY = ABS (TAY)
TAZ = ABS (TAZ)
TGX = ABS (TGX)
TGY = ABS (TGY)
TGZ = ABS (TGZ)
TSX = ABS (TSX)
TSY = ABS (TSY)
TSZ = ABS (TSZ)
```

CONT. ON PG 12

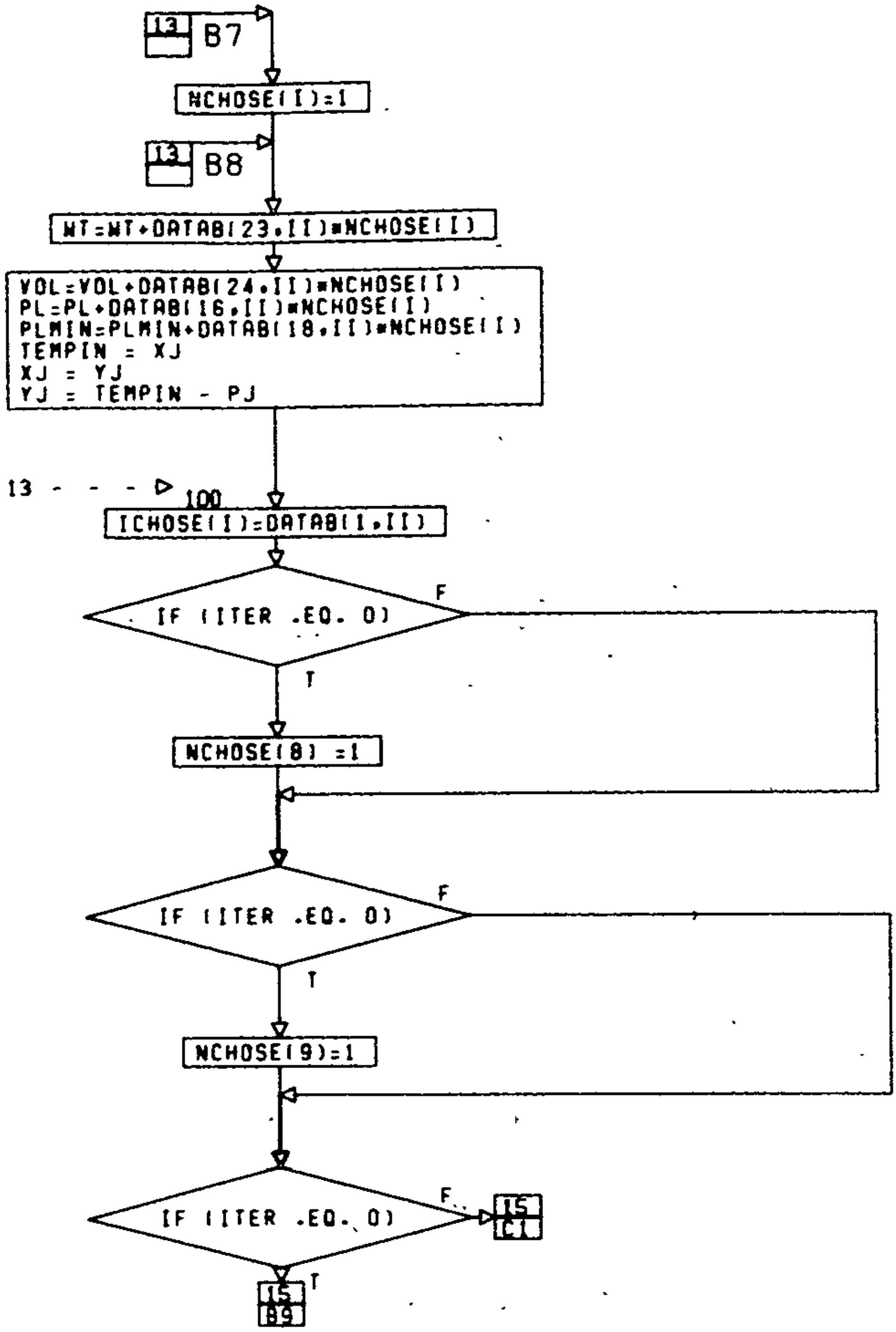

XMD = TAX + TGX + TSX
YMD= TAY + TGY + TSY
ZMD= TAZ + TGZ + TSZ
PRINT 9002,TAX,TAY,TAZ,TAUXA,TAUYA,TAUZA
9002
FORMAT (1X,5HTAX= E11.4,5HTAY= E11.4,5HTAZ= E11.4,7HTAUXA= E11.4,
7HTAUYA= E11.4,7HTAUZA= E11.4)
PRINT 9003,TSX,TSY,TSZ,TAUXS,TAUYS,TAUZS
9003
FORMAT (1X,5HTSX= E11.4,5HTSY= E11.4,5HTSZ= E11.4,7HTAUXS= E11.4,
7HTAUYS= E11.4,7HTAUZS= E11.4)
PRINT 9004,TGX,TGY,TGZ
9004
FORMAT (1X,5HTGX= E11.4,5HTGY= E11.4,5HTGZ= E11.4)
IF (NCONF(1) .EQ. 2)
F
T
GO TO 200
19
C9
IF (NCONF(1) .EQ. 3)
F
13
B6
T
GO TO 300
27
D9

CONT. ON PG 13

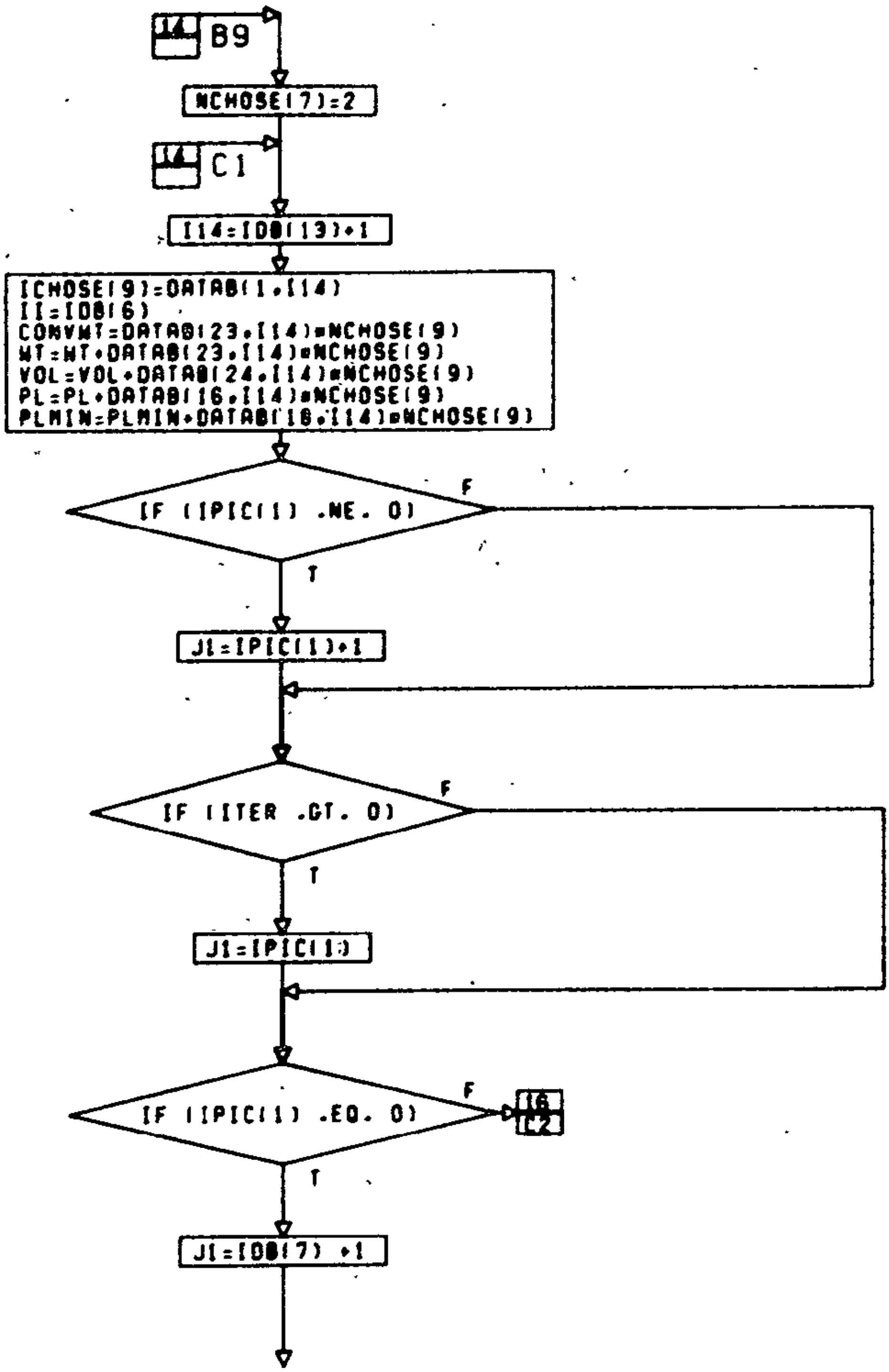


12
B6
IF (NCONF(1) .EQ. 4)
F
T
GO TO 400
34
F1
IF (NCONF(1) .EQ. 5)
F
T
GO TO 500
44
H2
C INITIALIZE FOR DUAL SPIN
IERR=0
IF (ITER .GT. 0)
F
T
DX=DX/12.
DO 100 I=1,7
14
II=IOB(I)
IF (ITER .EQ. 0)
F
14
B8
T
14
B7

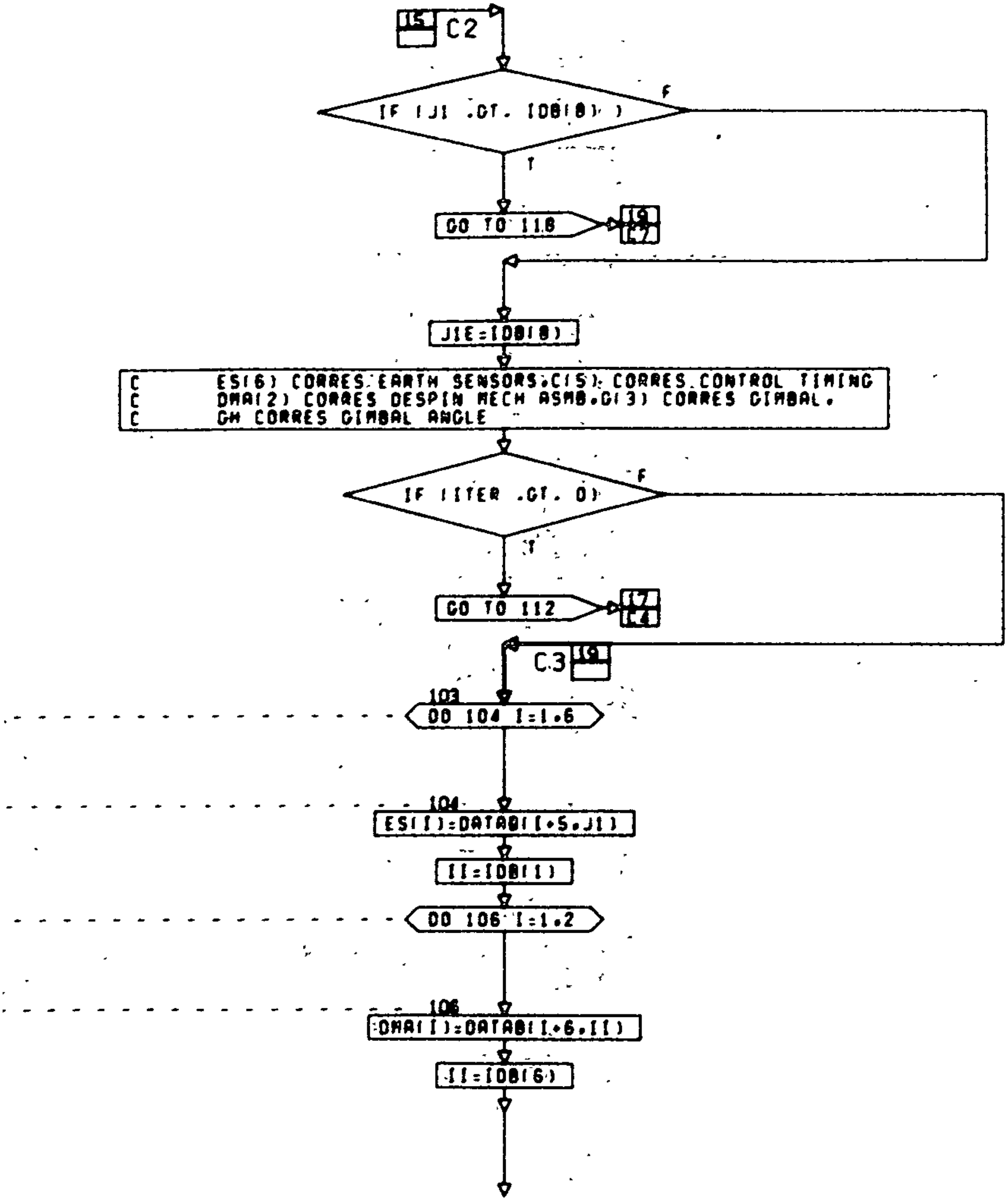
CONT. ON PG 14


13
B7
NCHOSE(I)=1
13
B8
WT=WT+DATAB(23,II)*NCHOSE(I)
VOL=VOL+DATAB(24,II)*NCHOSE(I)
PL=PL+DATAB(16,II)*NCHOSE(I)
PLMIN=PLMIN+DATAB(18,II)*NCHOSE(I)
TEMPIN = XJ
XJ = YJ
YJ = TEMPIN - PJ
13
100
ICHOSE(I)=DATAB(1,II)
IF (ITER .EQ. 0)
F
T
NCHOSE(8) =1
IF (ITER .EQ. 0)
F
T
NCHOSE(9)=1
IF (ITER .EQ. 0)
F
15
C1
T
15
B9

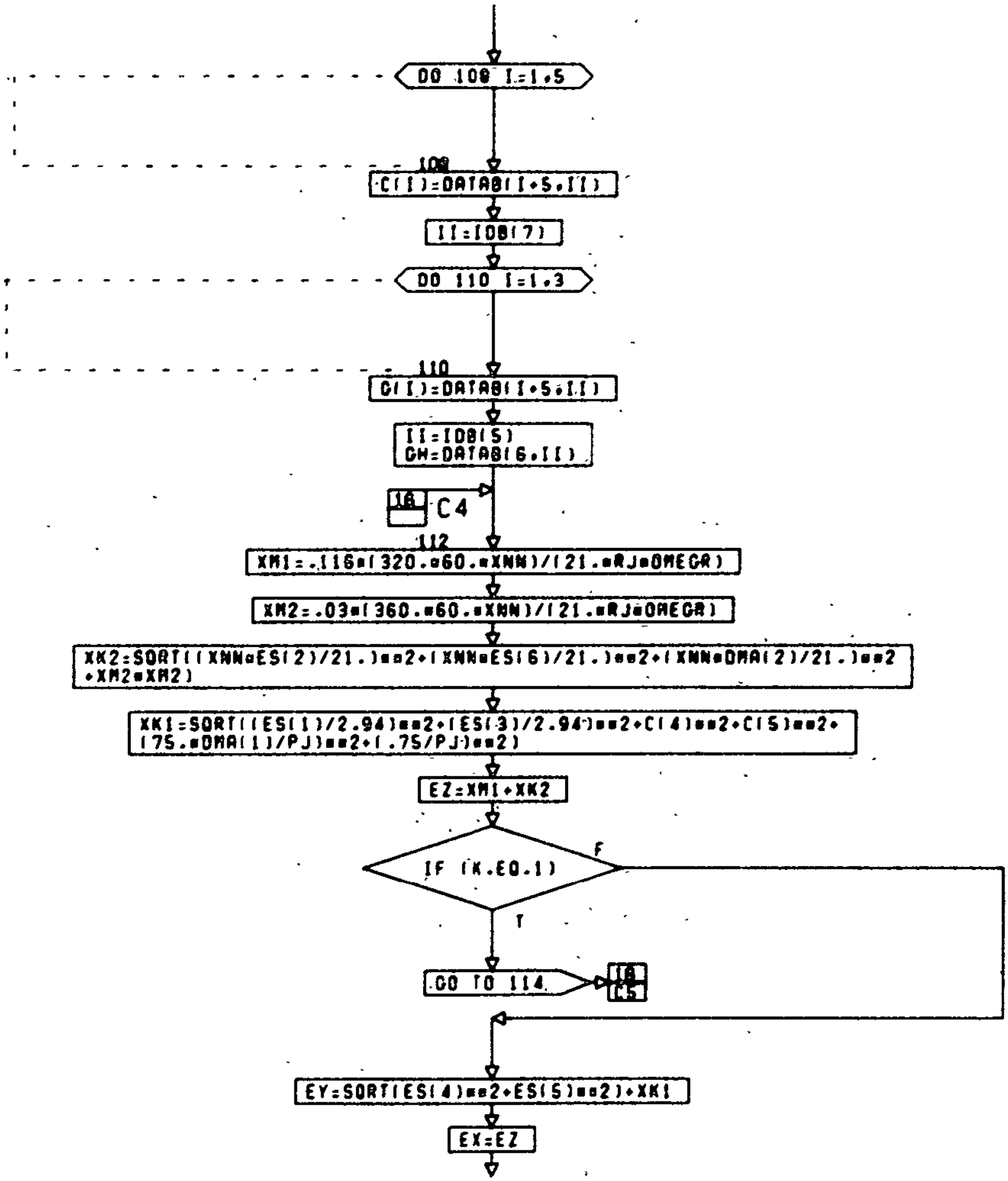
CONT. ON PG 15


14 B9
NCHOSE(7)=2
14 C1
I14=IDB(13)+1
ICHOSE(9)=DATAB(1,I14)
II=IDB(6)
CONVWT=DATAB(23,I14)*NCHOSE(9)
WT=WT+DATAB(23,I14)*NCHOSE(9)
VOL=VOL+DATAB(24,I14)*NCHOSE(9)
PL=PL+DATAB(16,I14)*NCHOSE(9)
PLMIN=PLMIN+DATAB(18,I14)*NCHOSE(9)
IF (IPIC(1) .NE. 0)
F
T
J1=IPIC(1)+1
IF (ITER .GT. 0)
F
T
J1=IPIC(1)
IF (IPIC(1) .EQ. 0)
F
16 C2
T
J1=IDB(7) +1

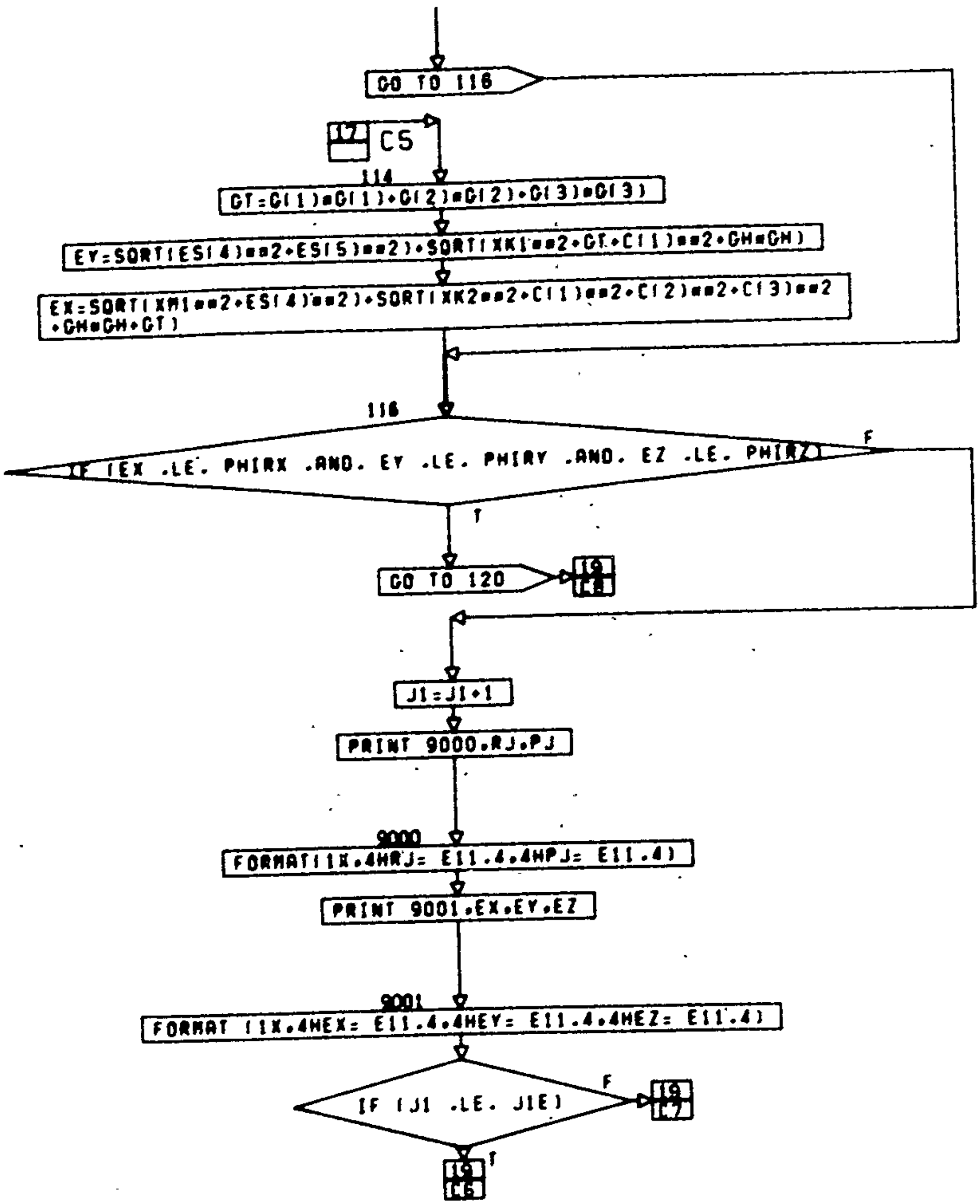
CONT. ON PG 16


15
C2
IF (J1 .GT. IDB(8))
F
T
GO TO 118
19
C7
J1E=IDB(8)
C ES(6) CORRES EARTH SENSORS,C(5) CORRES CONTROL TIMING
C DMA(2) CORRES DESPIN MECH ASMB,G(3) CORRES GIMBAL,
C GH CORRES GIMBAL ANGLE
IF (ITER .GT. 0)
F
T
GO TO 112
17
C4
C3
19
103
DO 104 I=1,6
104
ES(I)=DATAB(I+5,J1)
I1=IDB(1)
DO 106 I=1,2
106
DMA(I)=DATAB(I+6,I1)
I1=IDB(6)

CONT. ON PG 17

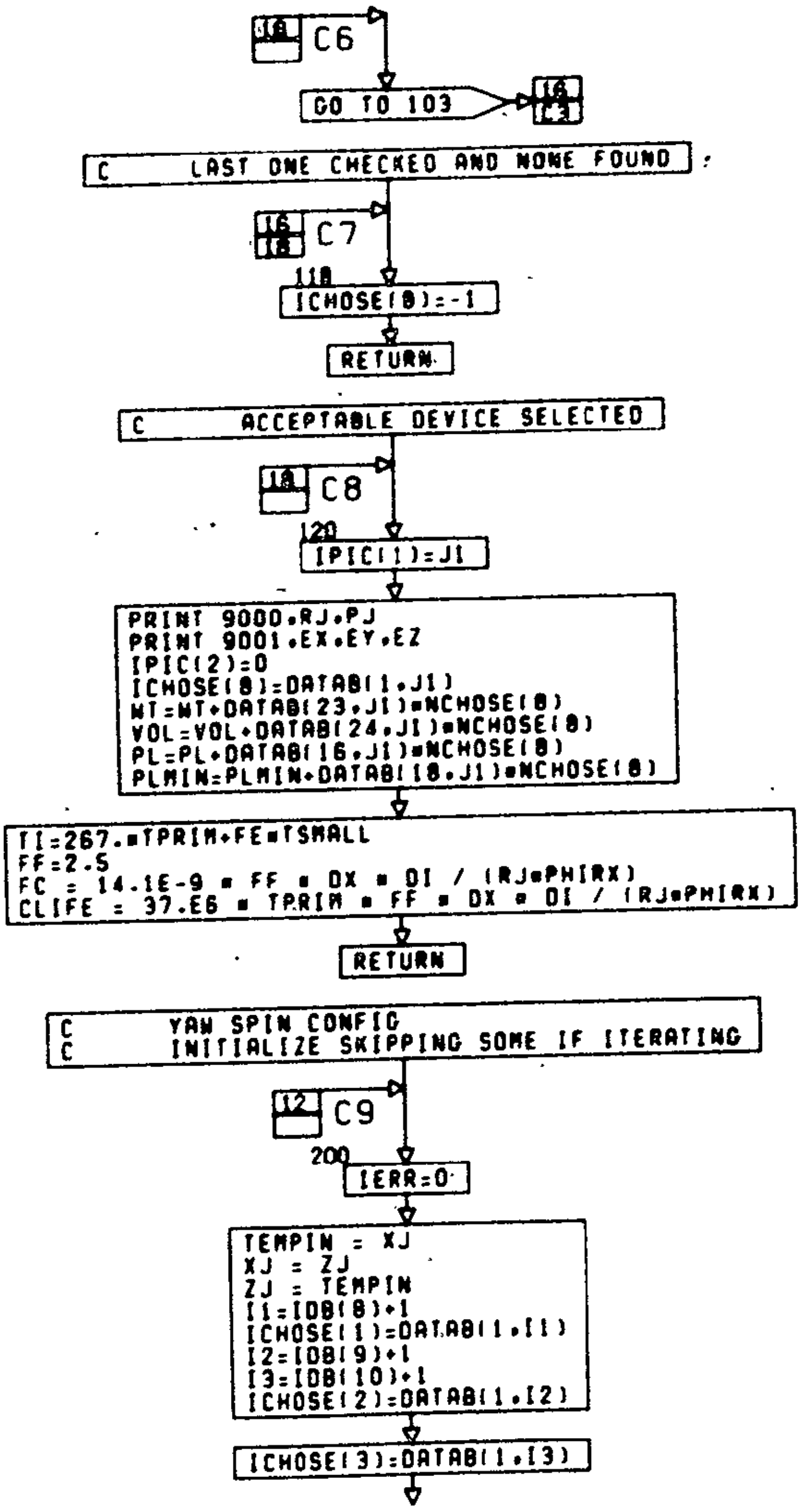

DO 108 I=1,5
108
C(I)=DATAB(I+5,II)
II=IDB(7)
DO 110 I=1,3
110
C(I)=DATAB(I+5,II)
II=IDB(5)
GH=DATAB(6,II)
18
C4
112
XM1=.116*(320.*60.*XNN)/(21.*RJ*OMEGR)
XM2=.03*(360.*60.*XNN)/(21.*RJ*OMEGR)
XK2=SQRT((XNN*ES(2)/21.)**2+(XNN*ES(6)/21.)**2+(XNN*DMA(2)/21.)**2
+XM2*XM2)
XK1=SQRT((ES(1)/2.94)**2+(ES(3)/2.94)**2+C(4)**2+C(5)**2+
(75.*DMA(1)/PJ)**2+(.75/PJ)**2)
EZ=XM1+XK2
IF (K.EQ.1)
F
T
GO TO 114
18
C5
EY=SQRT(ES(4)**2+ES(5)**2)+XK1
EX=EZ

CONT. ON PG 18



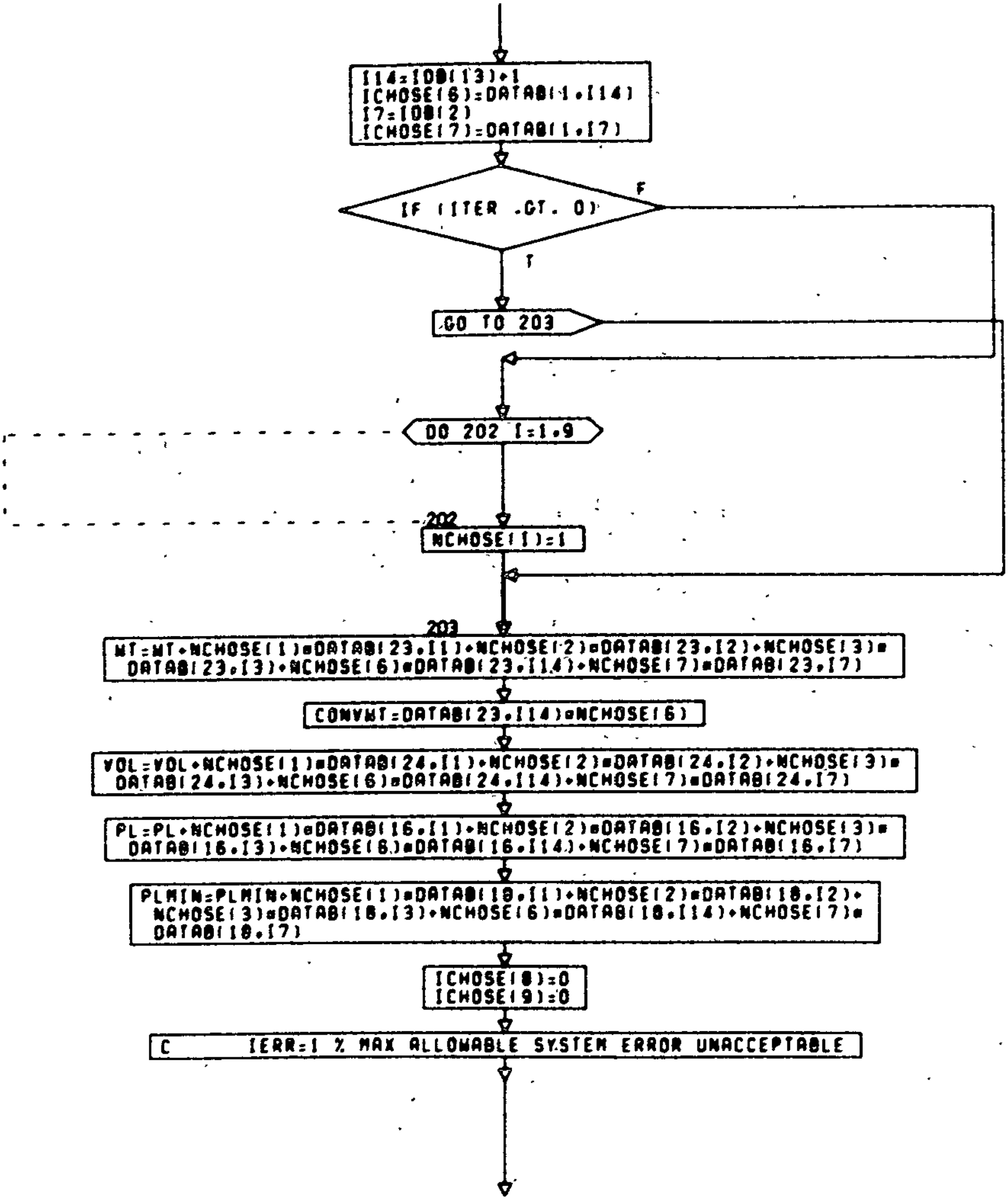
GO TO 116
17
C5
114
GT=G(1)*G(1)+G(2)*G(2)+G(3)*G(3)
EY=SQRT(ES(4)**2+ES(5)**2)+SQRT(XK1**2+GT+C(1)**2+GH*GH)
EX=SQRT(XM1**2+ES(4)**2)+SQRT(XK2**2+C(1)**2+C(2)**2+C(3)**2
+GH*GH+GT)
116
IF (EX .LE. PHIRX .AND. EY .LE. PHIRY .AND. EZ .LE. PHIRZ)
F
T
GO TO 120
19
J1=J1+1
PRINT 9000,RJ,PJ
9000
FORMAT(1X,4HRJ= E11.4,4HPJ= E11.4)
PRINT 9001,EX,EY,EZ
9001
FORMAT (1X,4HEX= E11.4,4HEY= E11.4,4HEZ= E11.4)
IF (J1 .LE. J1E)
F
19
C7
T
19
C6

CONT. ON PG 19

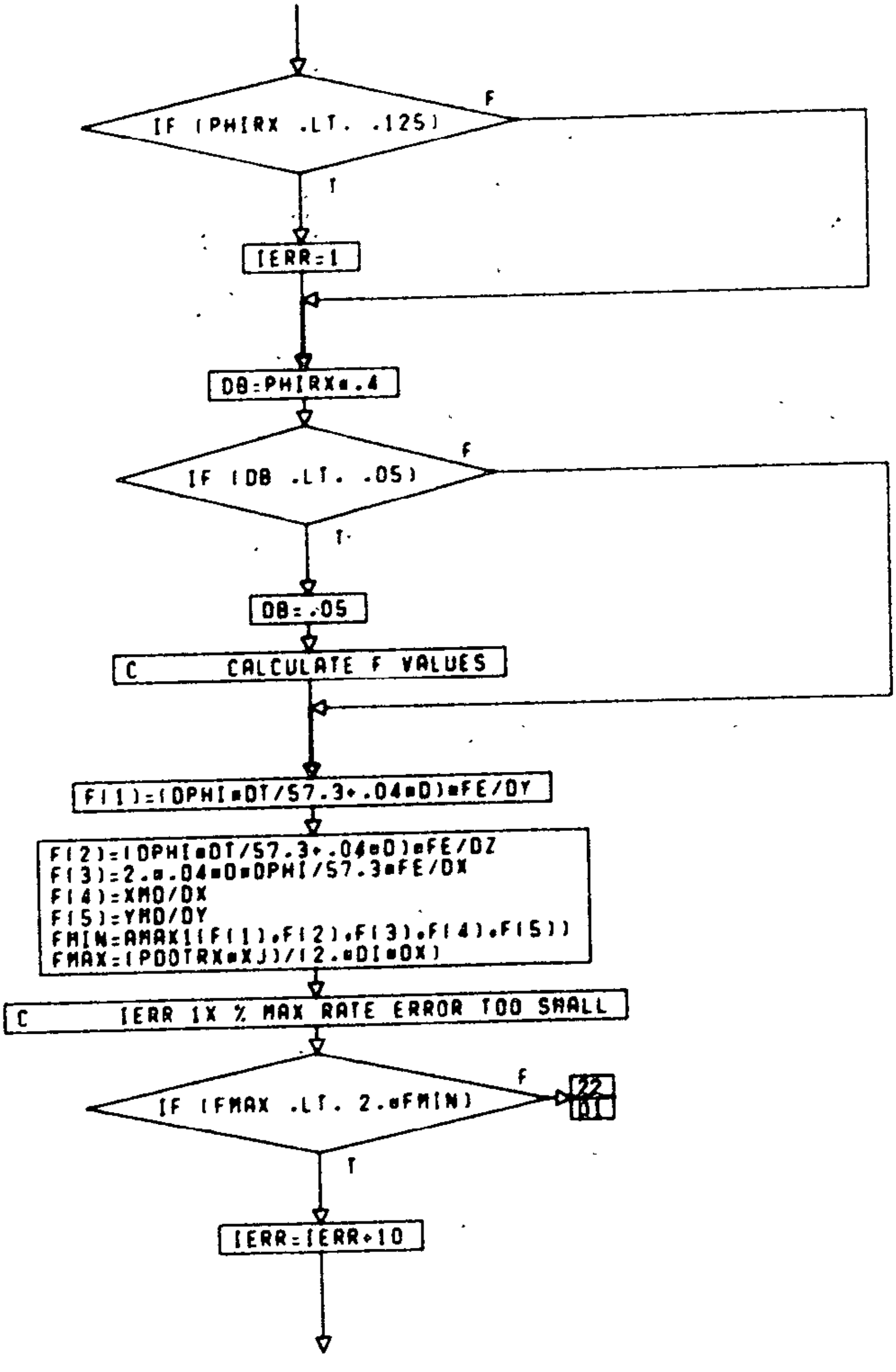


C6
GO TO 103
C LAST ONE CHECKED AND NONE FOUND
C7
118
ICHOSE(8)=-1
RETURN
C ACCEPTABLE DEVICE SELECTED
C8
120
IPIC(1)=J1
PRINT 9000,RJ,PJ
PRINT 9001,EX,EY,EZ
IPIC(2)=0
ICHOSE(8)=DATAB(1,J1)
WT=WT+DATAB(23,J1)*NCHOSE(8)
VOL=VOL+DATAB(24,J1)*NCHOSE(8)
PL=PL+DATAB(16,J1)*NCHOSE(8)
PLMIN=PLMIN+DATAB(18,J1)*NCHOSE(8)
TI=267.*TPRIM+FE*TSMALL
FF=2.5
FC = 14.1E-9 * FF * DX * DI / (RJ*PHIRX)
CLIFE = 37.E6 * TPRIM * FF * DX * DI / (RJ*PHIRX)
RETURN
C YAW SPIN CONFIG
C INITIALIZE SKIPPING SOME IF ITERATING
C9
200
IERR=0
TEMPIN = XJ
XJ = ZJ
ZJ = TEMPIN
I1=IDB(8)+1
ICHOSE(1)=DATAB(1,I1)
I2=IDB(9)+1
I3=IDB(10)+1
ICHOSE(2)=DATAB(1,I2)
ICHOSE(3)=DATAB(1,I3)

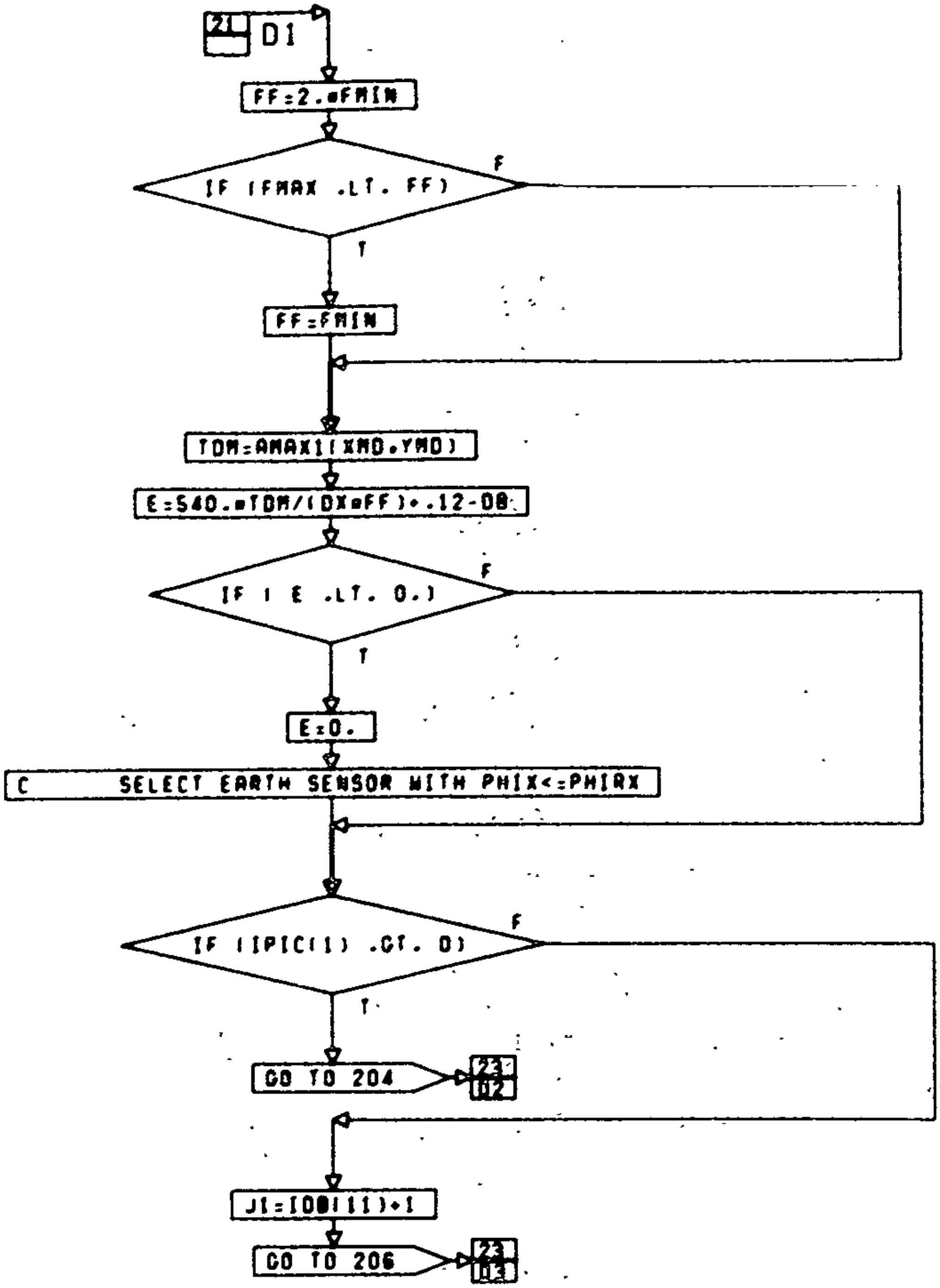
CONT. ON PG 20


I14=IDB(13)+1
ICHOSE(6)=DATAB(1,I14)
I7=IDB(2)
ICHOSE(7)=DATAB(1,I7)
IF (ITER .GT. 0)
F
T
GO TO 203
DO 202 I=1,9
202
NCHOSE(I)=1
203
WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)+NCHOSE(3)*
DATAB(23,I3)+NCHOSE(6)*DATAB(23,I14)+NCHOSE(7)*DATAB(23,I7)
CONVWT=DATAB(23,I14)*NCHOSE(6)
VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)+NCHOSE(3)*
DATAB(24,I3)+NCHOSE(6)*DATAB(24,I14)+NCHOSE(7)*DATAB(24,I7)
PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)+NCHOSE(3)*
DATAB(16,I3)+NCHOSE(6)*DATAB(16,I14)+NCHOSE(7)*DATAB(16,I7)
PLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)+
NCHOSE(3)*DATAB(18,I3)+NCHOSE(6)*DATAB(18,I14)+NCHOSE(7)*
DATAB(18,I7)
ICHOSE(8)=0
ICHOSE(9)=0
C IERR=1 % MAX ALLOWABLE SYSTEM ERROR UNACCEPTABLE

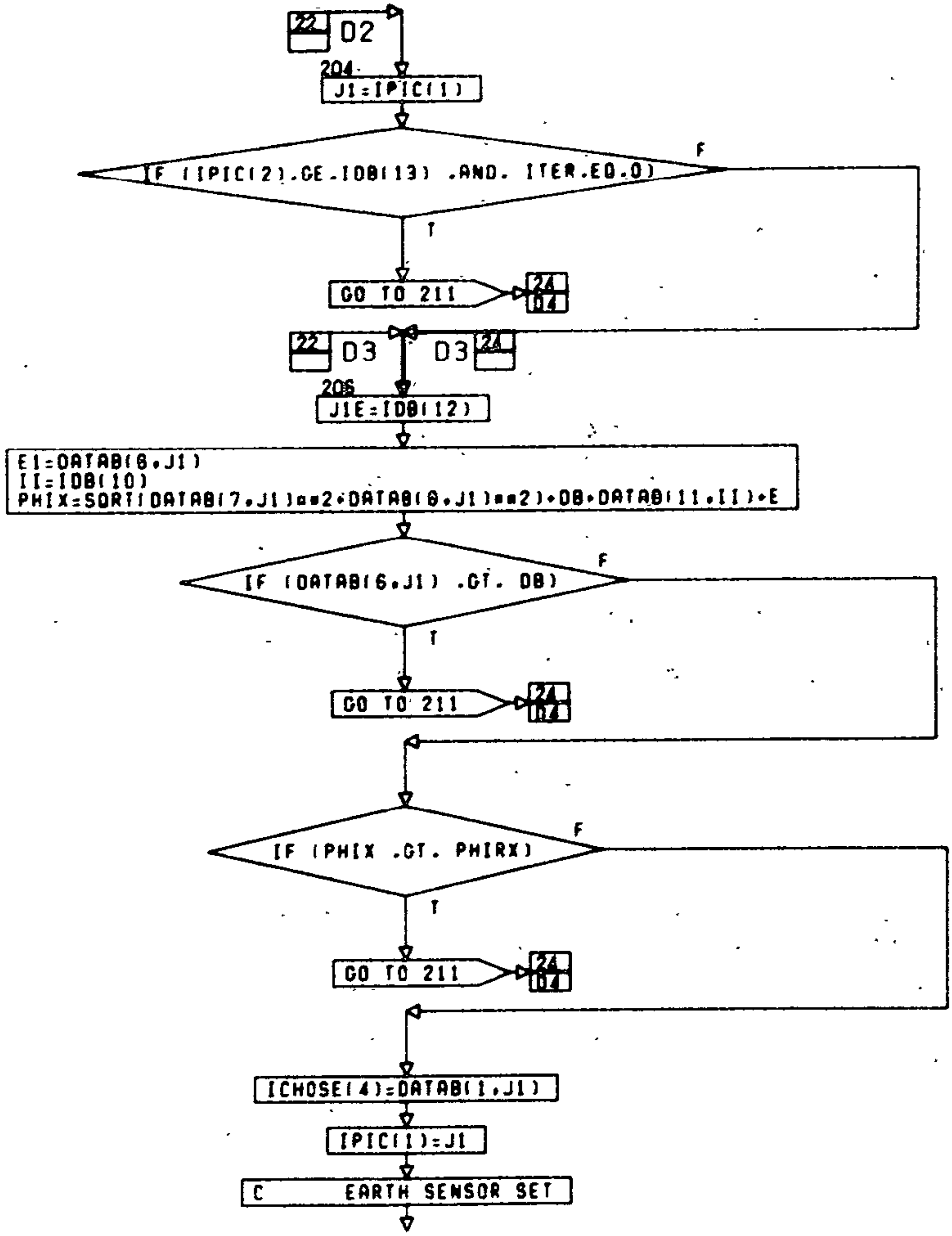
CONT. ON PG 21


IF (PHIRX .LT. .125)
F
T
IERR=1
DB=PHIRX*.4
IF (DB .LT. .05)
F
T
DB=.05
C CALCULATE F VALUES
F(1)=(DPHI*DT/57.3+.04*D)*FE/DY
F(2)=(DPHI*DT/57.3+.04*D)*FE/DZ
F(3)=2.*.04*D*DPHI/57.3*FE/DX
F(4)=XMD/DX
F(5)=YMD/DY
FMIN=AMAX1(F(1),F(2),F(3),F(4),F(5))
FMAX=(PDOTRX*XJ)/(2.*DI*DX)
C IERR 1X % MAX RATE ERROR TOO SMALL
IF (FMAX .LT. 2.*FMIN)
F
22
D1
T
IERR=IERR+10

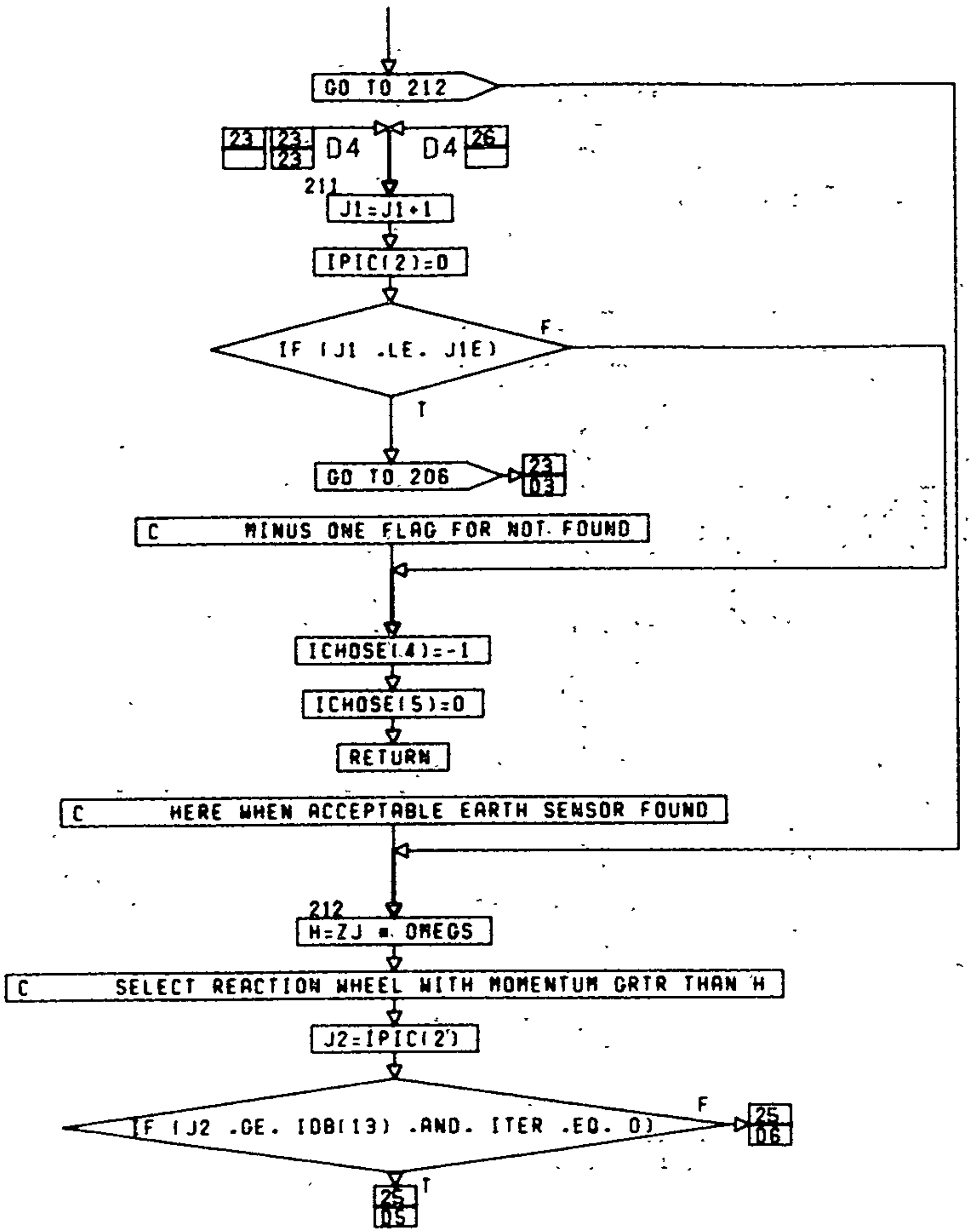
CONT. ON PG 22


21
D1
FF=2.*FMIN
IF (FMAX .LT. FF)
F
T
FF=FMIN
TDM=AMAX1(XMD,YMD)
E=540.*TDM/(DX*FF)+.12-08
IF (E .LT. 0.)
F
T
E=0.
C SELECT EARTH SENSOR WITH PHIX<=PHIRX
IF (IPIC(1) .GT. 0)
F
T
GO TO 204
23
D2
JI=IDB(11)+1
GO TO 206
23
D3

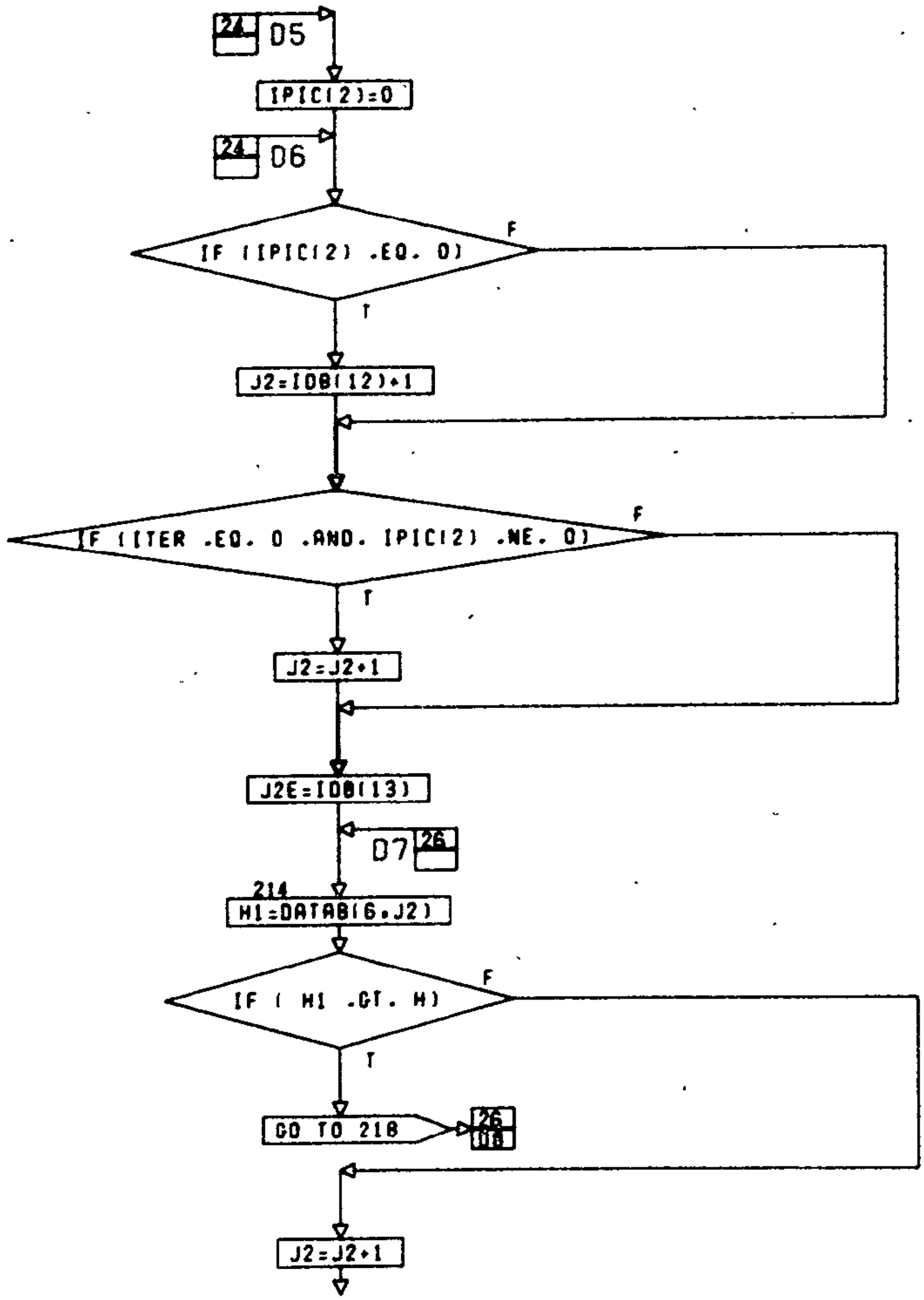
CONT. ON PG 23


22
D2
204
J1=IPIC(1)
IF (IPIC(2).GE.IDB(13) .AND. ITER.EQ.0)
F
T
GO TO 211
24
D4
22
D3
D3
24
206
J1E=IDB(12)
E1=DATAB(8,J1)
II=IDB(10)
PHIX=SQRT(DATAB(7,J1)**2+DATAB(8,J1)**2)+DB+DATAB(11,II)+E
IF (DATAB(6,J1) .GT. DB)
F
T
GO TO 211
24
D4
IF (PHIX .GT. PHIRX)
F
T
GO TO 211
24
D4
ICHOSE(4)=DATAB(1,J1)
IPIC(1)=J1
C EARTH SENSOR SET

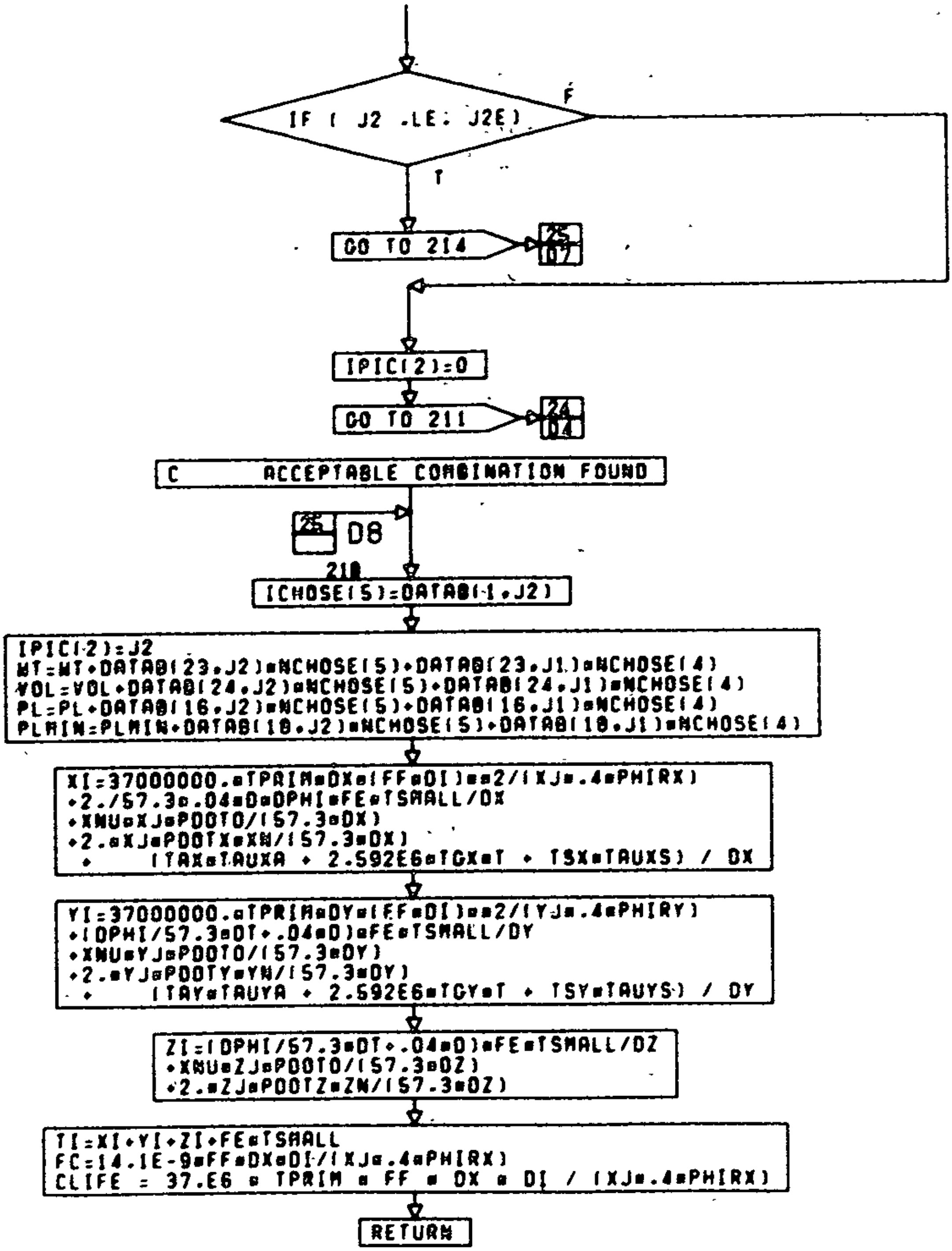
CONT. ON PG 24


GO TO 212
23
23
23
D4
D4
26
211
J1=J1+1
IPIC(2)=0
IF (J1 .LE. J1E)
F
T
GO TO 206
23
D3
C MINUS ONE FLAG FOR NOT FOUND
ICHOSE(4)=-1
ICHOSE(5)=0
RETURN
C HERE WHEN ACCEPTABLE EARTH SENSOR FOUND
212
H=ZJ * OMEGS
C SELECT REACTION WHEEL WITH MOMENTUM GRTR THAN H
J2=IPIC(2)
IF (J2 .GE. IDB(13) .AND. ITER .EQ. 0)
F
25
D6
T
25
D5

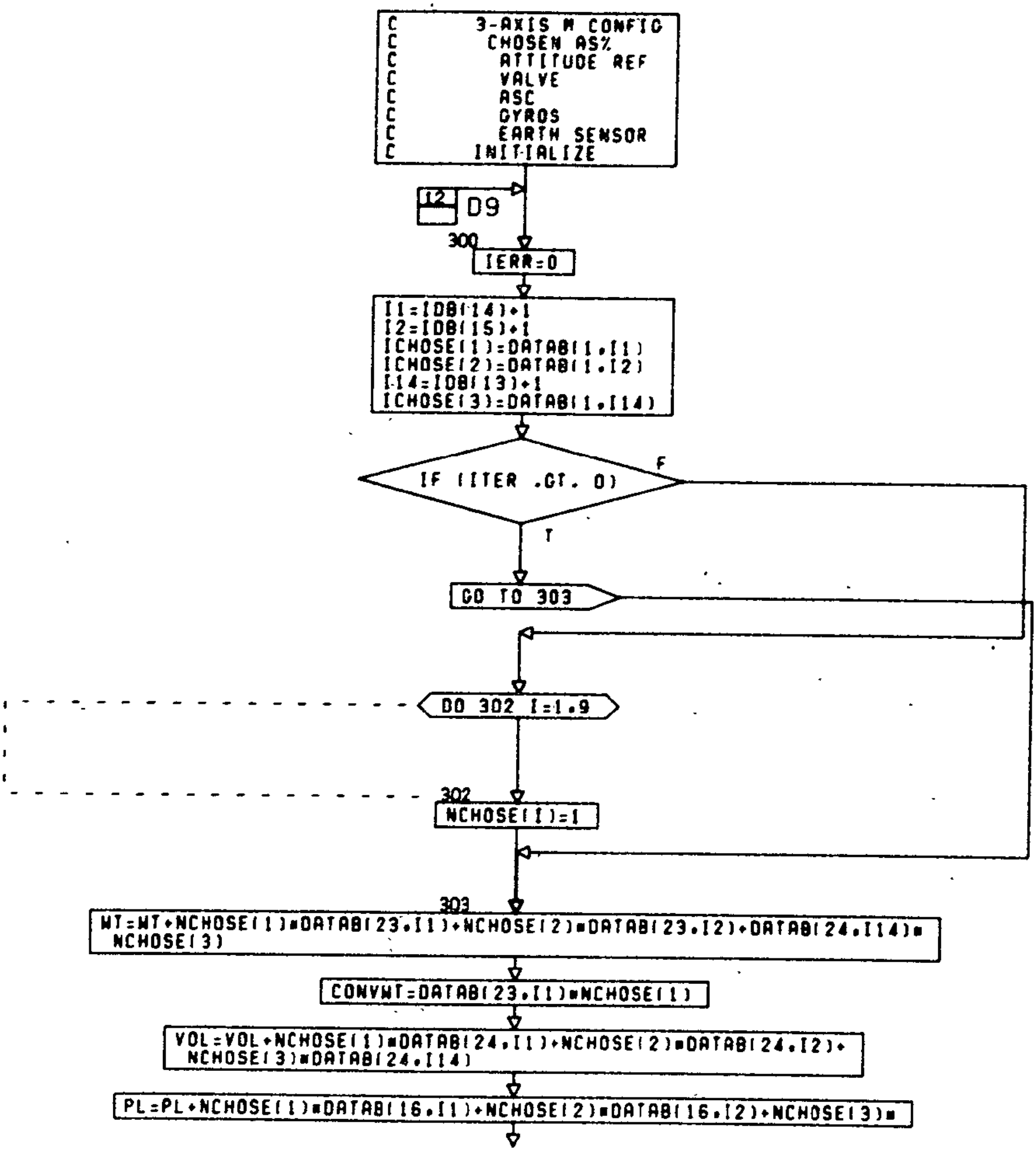
CONT. ON PG 25


24
D5
IPIC(2)=0
24
D6
IF (IPIC(2) .EQ. 0)
F
T
J2=IDB(12)+1
IF (ITER .EQ. 0 .AND. IPIC(2) .NE. 0)
F
T
J2=J2+1
J2E=IDB(13)
D7
26
214
H1=DATAB(6,J2)
IF (H1 .GT. H)
F
T
GO TO 218
26
D8
J2=J2+1

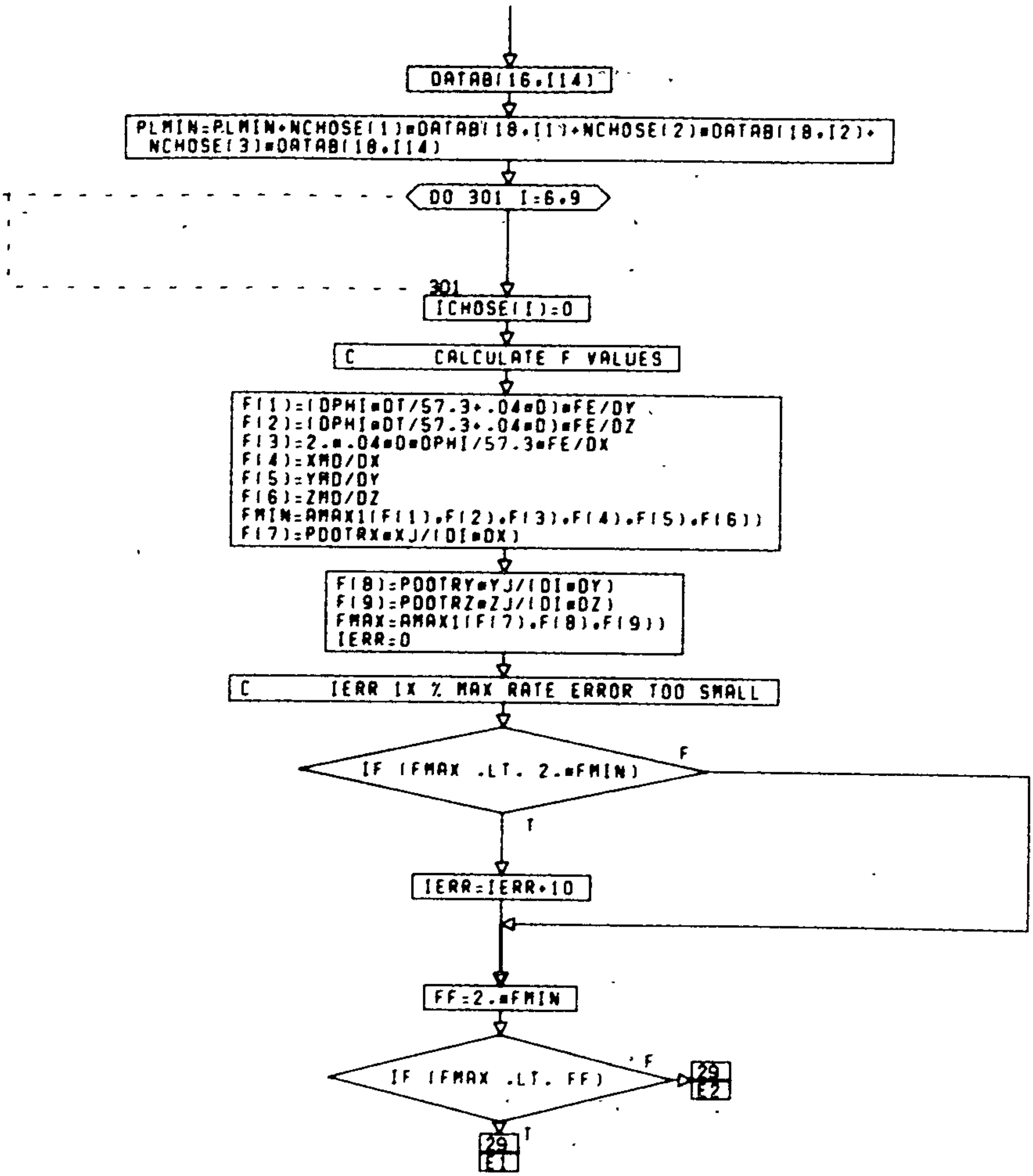
CONT. ON PG 26


IF (J2 .LE. J2E)
F
T
GO TO 214
25
D7
IPIC(2)=0
GO TO 211
24
D4
C ACCEPTABLE COMBINATION FOUND
25
D8
218
ICHOSE(5)=DATAB(1,J2)
IPIC(2)=J2
WT=WT+DATAB(23,J2)*NCHOSE(5)+DATAB(23,J1)*NCHOSE(4)
VOL=VOL+DATAB(24,J2)*NCHOSE(5)+DATAB(24,J1)*NCHOSE(4)
PL=PL+DATAB(16,J2)*NCHOSE(5)+DATAB(16,J1)*NCHOSE(4)
PLMIN=PLMIN+DATAB(18,J2)*NCHOSE(5)+DATAB(18,J1)*NCHOSE(4)
XI=37000000.*TPRIM*DX*(FF*DI)**2/(XJ*.4*PHIRX)
+2./57.3*.04*D*DPHI*FE*TSMALL/DX
+XNU*XJ*PDOTO/(57.3*DX)
+2.*XJ*PDOTX*XN/(57.3*DX)
+ (TAX*TAUXA + 2.592E6*TGX*T + TSX*TAUXS) / DX
YI=37000000.*TPRIM*DY*(FF*DI)**2/(YJ*.4*PHIRY)
+(DPHI/57.3*DT+.04*D)*FE*TSMALL/DY
+XNU*YJ*PDOTO/(57.3*DY)
+2.*YJ*PDOTY*YN/(57.3*DY)
+ (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS) / DY
ZI=(DPHI/57.3*DT+.04*D)*FE*TSMALL/DZ
+XNU*ZJ*PDOTO/(57.3*DZ)
+2.*ZJ*PDOTZ*ZN/(57.3*DZ)
TI=XI+YI+ZI+FE*TSMALL
FC=14.1E-9*FF*DX*DI/(XJ*.4*PHIRX)
CLIFE = 37.E6 * TPRIM * FF * DX * DI / (XJ*.4*PHIRX)
RETURN

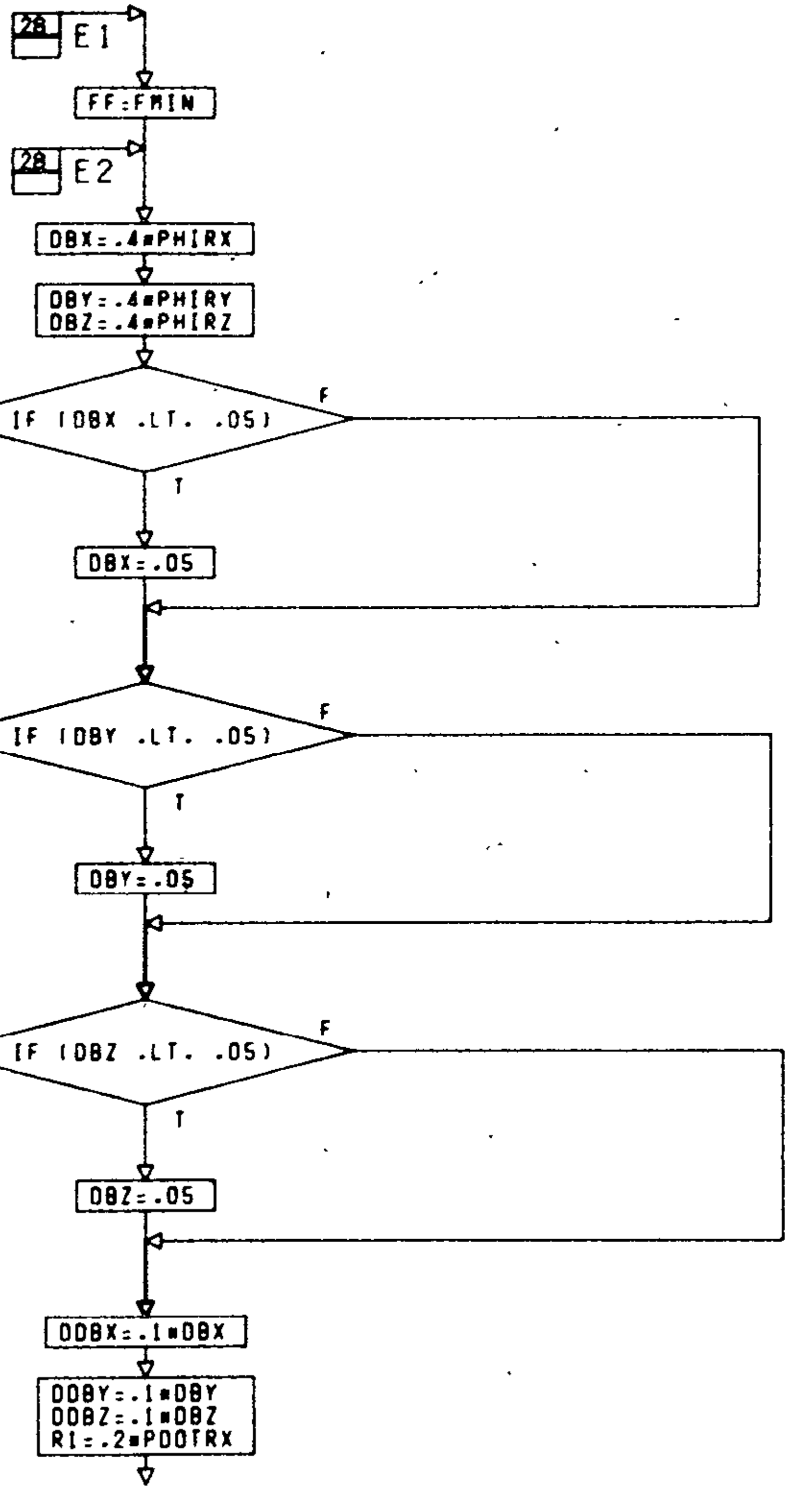
CONT. ON PG 27


C 3-AXIS M CONFIG
C CHOSEN AS%
C ATTITUDE REF
C VALVE
C ASC
C GYROS
C EARTH SENSOR
C INITIALIZE
12
D9
300
IERR=0
I1=IDB(14)+1
I2=IDB(15)+1
ICHOSE(1)=DATAB(1,I1)
ICHOSE(2)=DATAB(1,I2)
I14=IDB(13)+1
ICHOSE(3)=DATAB(1,I14)
IF (ITER .GT. 0)
F
T
GO TO 303
DO 302 I=1,9
302
NCHOSE(I)=1
303
WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)+DATAB(24,I14)* NCHOSE(3)
CONVWT=DATAB(23,I1)*NCHOSE(1)
VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)+ NCHOSE(3)*DATAB(24,I14)
PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)+NCHOSE(3)*

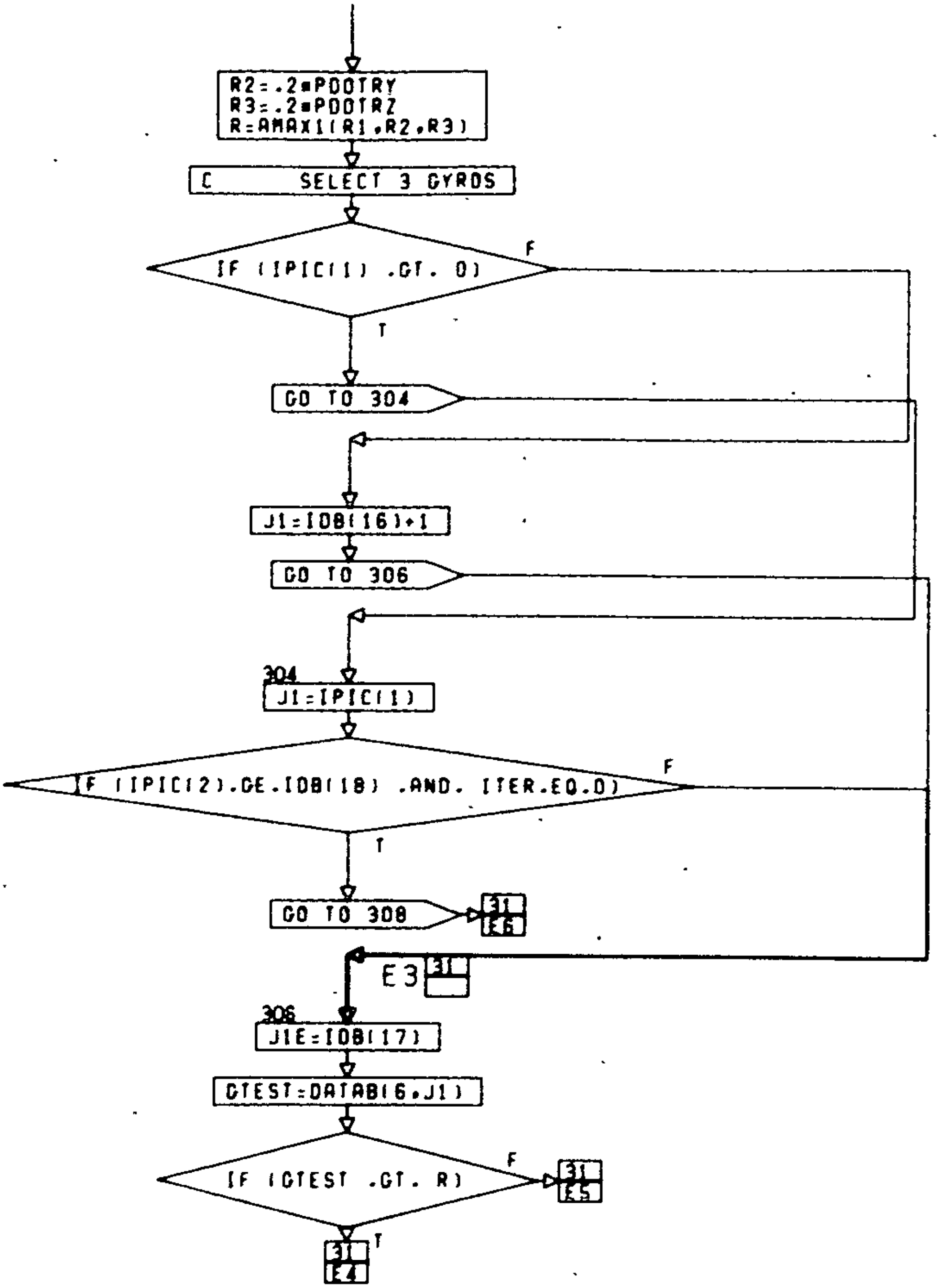
CONT. ON PG 28


DATAB(16,I14)
PLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)+
NCHOSE(3)*DATAB(18,I14)
DO 301 I=6,9
301
ICHOSE(I)=0
C CALCULATE F VALUES
F(1)=(DPHI*DT/57.3+.04*D)*FE/DY
F(2)=(DPHI*DT/57.3+.04*D)*FE/DZ
F(3)=2.*.04*D*DPHI/57.3*FE/DX
F(4)=XMD/DX
F(5)=YMD/DY
F(6)=ZMD/DZ
FMIN=AMAX1(F(1),F(2),F(3),F(4),F(5),F(6))
F(7)=PDOTRX*XJ/(DI*DX)
F(8)=PDOTRY*YJ/(DI*DY)
F(9)=PDOTRZ*ZJ/(DI*DZ)
FMAX=AMAX1(F(7),F(8),F(9))
IERR=0
C IERR IX % MAX RATE ERROR TOO SMALL
IF (FMAX .LT. 2.*FMIN)
F
T
IERR=IERR+10
FF=2.*FMIN
IF (FMAX .LT. FF)
F
29
E2
T
29
E1

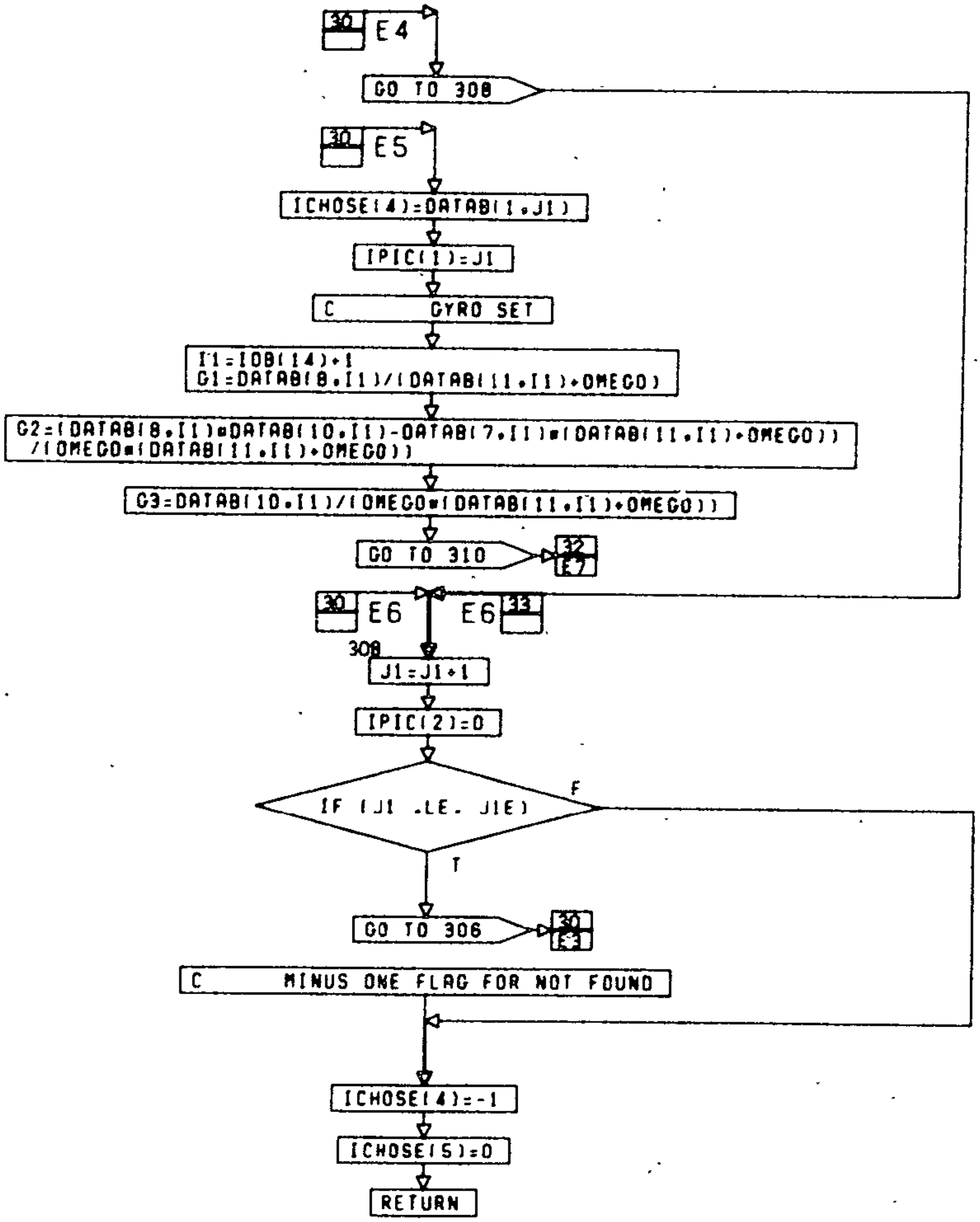
CONT. ON PG 29


28
E1
FF:FMIN
28
E2
DBX:.4*PHIRX
DBY:.4*PHIRY
DBZ:.4*PHIRZ
IF (DBX .LT. .05)
F
T
DBX:.05
IF (DBY .LT. .05)
F
T
DBY:.05
IF (DBZ .LT. .05)
F
T
DBZ:.05
DDBX:.1*DBX
DDBY:.1*DBY
DDBZ:.1*DBZ
RI:.2*PDOTRX

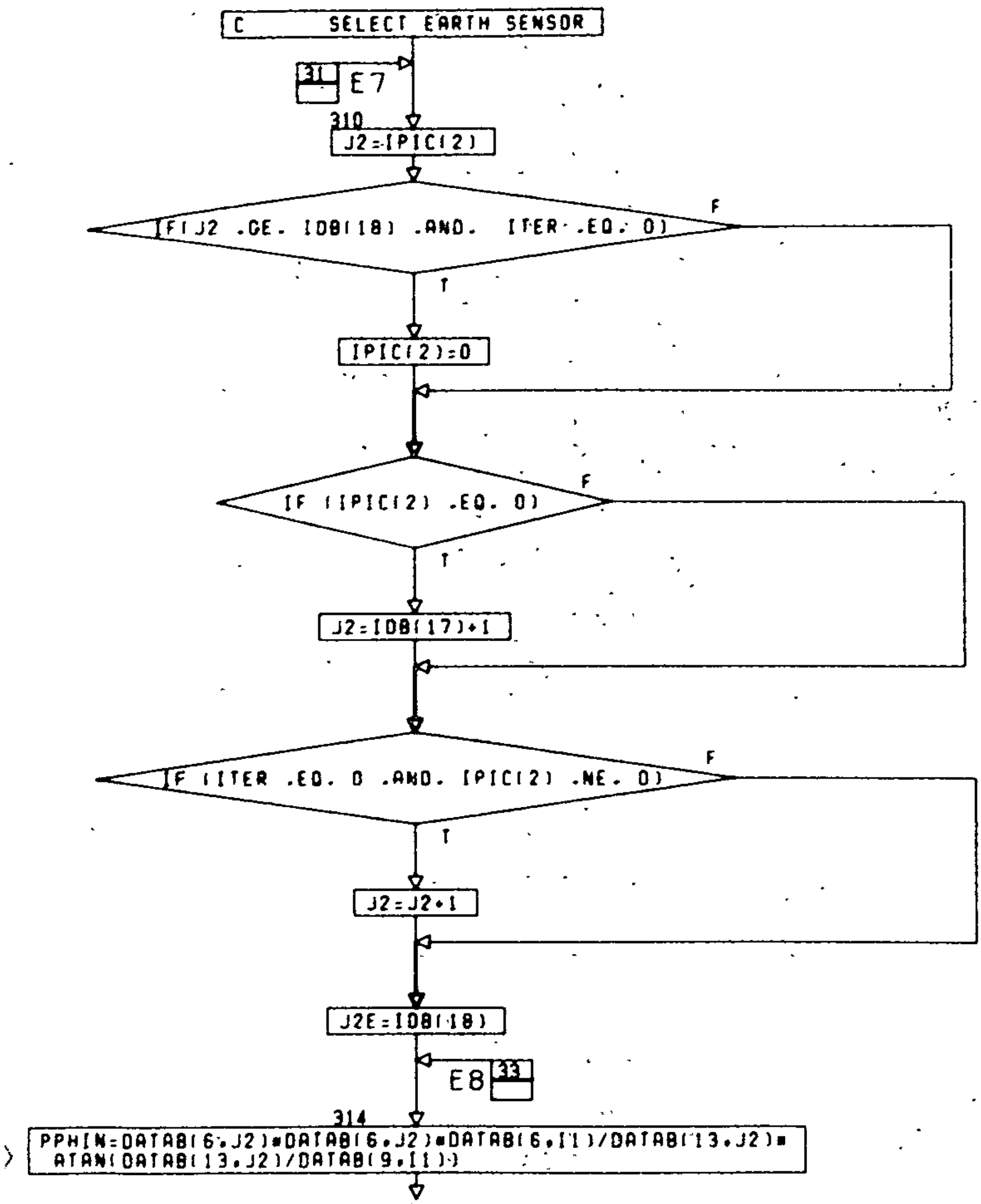
CONT. ON PG 30


R2=.2*PDOTRY
R3=.2*PDOTRZ
R=AMAX1(R1,R2,R3)
C SELECT 3 GYROS
IF (IPIC(1) .GT. 0)
F
T
GO TO 304
J1=IDB(16)+1
GO TO 306
304
J1=IPIC(1)
IF (IPIC(2).GE.IDB(18) .AND. ITER.EQ.0)
F
T
GO TO 308
31
E6
E3
31
306
J1E=IDB(17)
DTEST=DATAB(6,J1)
IF (DTEST .GT. R)
F
31
E5
T
31
E4

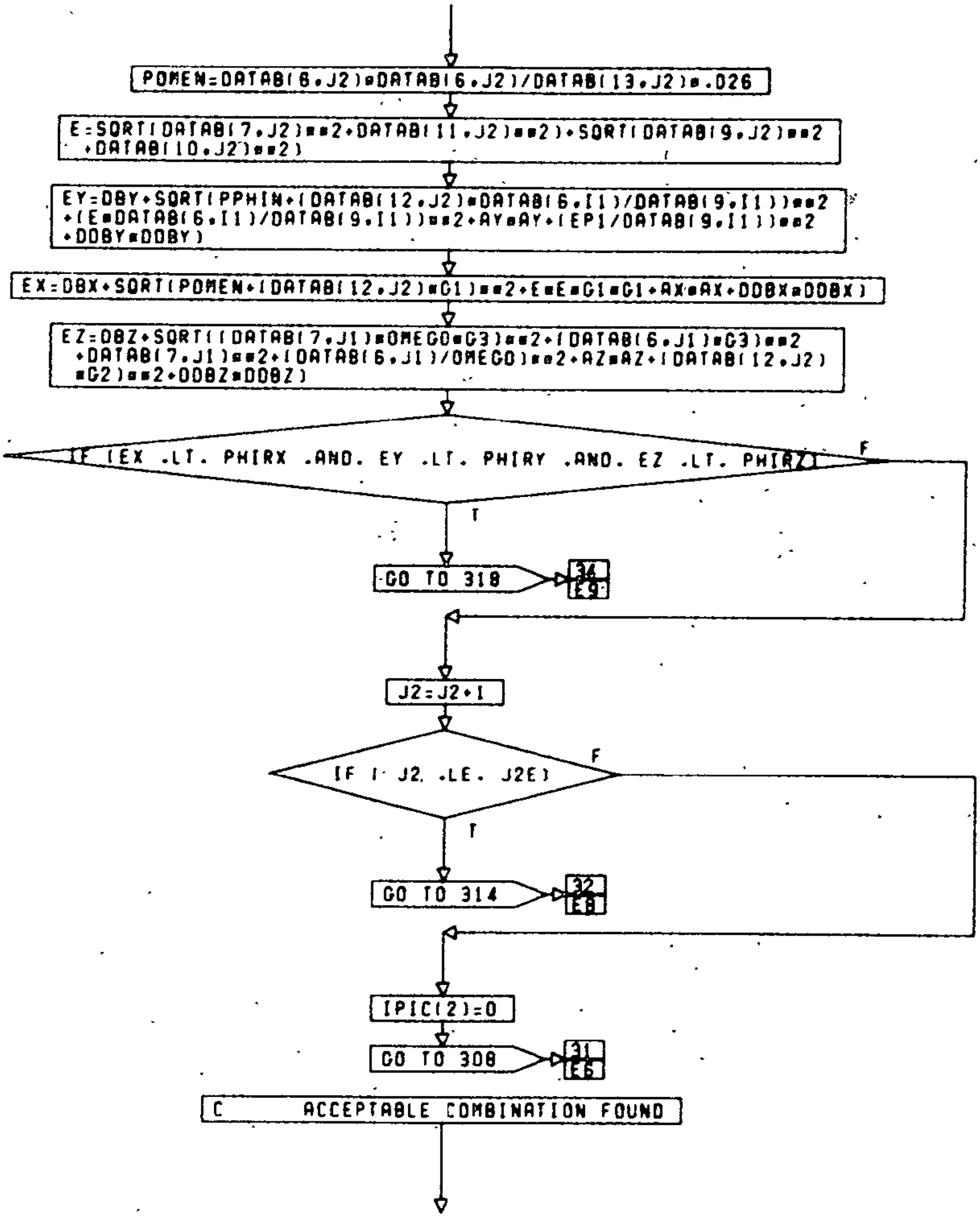
CONT. ON PG 31


30
E4
GO TO 308
30
E5
ICHOSE(4)=DATAB(1,J1)
IPIC(1)=J1
C GYRO SET
I1=IDB(14)+1
G1=DATAB(8,I1)/(DATAB(11,I1)+OMEGO)
G2=(DATAB(8,I1)*DATAB(10,I1)-DATAB(7,I1)*(DATAB(11,I1)+OMEGO))
/(OMEGO*(DATAB(11,I1)+OMEGO))
G3=DATAB(10,I1)/(OMEGO*(DATAB(11,I1)+OMEGO))
GO TO 310
32
E7
30
E6
E6
33
308
J1=J1+1
IPIC(2)=0
IF (J1 .LE. J1E)
F
T
GO TO 306
30
E3
C MINUS ONE FLAG FOR NOT FOUND
ICHOSE(4)=-1
ICHOSE(5)=0
RETURN

CONT. ON PG 32


C SELECT EARTH SENSOR
31
E7
310
J2=IPIC(2)
IF(J2 .GE. IDB(18) .AND. ITER .EQ. 0)
F
T
IPIC(2)=0
IF (IPIC(2) .EQ. 0)
F
T
J2=IDB(17)+1
IF (ITER .EQ. 0 .AND. IPIC(2) .NE. 0)
F
T
J2=J2+1
J2E=IDB(18)
E8
33
314
PPHIN=DATAB(6,J2)*DATAB(6,J2)*DATAB(6,I1)/DATAB(13,J2)*
ATAN(DATAB(13,J2)/DATAB(9,I1))

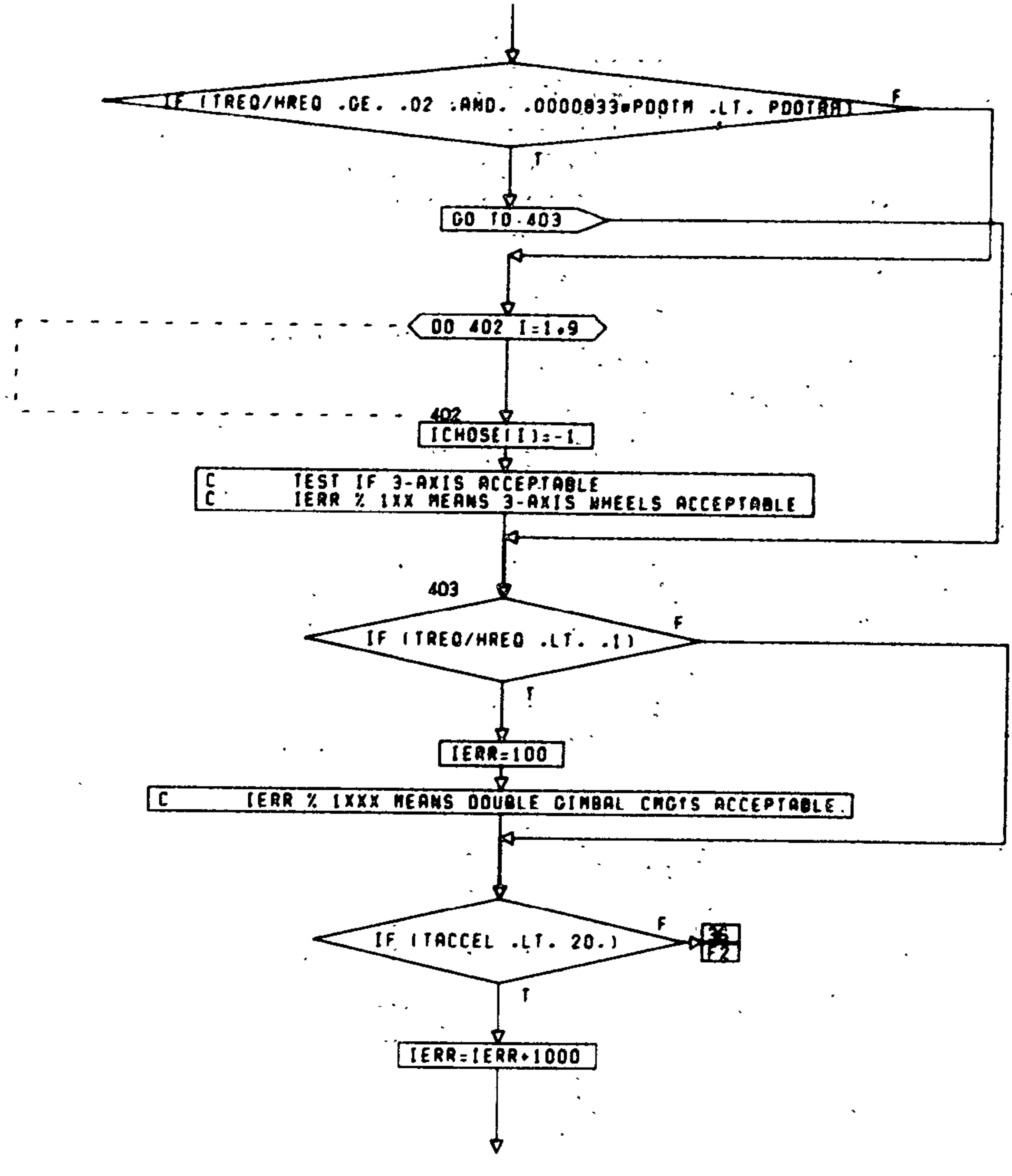
CONT. ON PG 33


POMEN=DATAB(6,J2)*DATAB(6,J2)/DATAB(13,J2)*.026
E=SQRT(DATAB(7,J2)**2+DATAB(11,J2)**2)+SQRT(DATAB(9,J2)**2
+DATAB(10,J2)**2)
EY=DBY+SQRT(PPHIN+(DATAB(12,J2)*DATAB(6,I1)/DATAB(9,I1))**2
+(E*DATAB(6,I1)/DATAB(9,I1))**2+AY*AY+(EP1/DATAB(9,I1))**2
+DDBY*DDBY)
EX=DBX+SQRT(POMEN+(DATAB(12,J2)*G1)**2+E*E*G1*G1+AX*AX+DDBX*DDBX)
EZ=DBZ+SQRT((DATAB(7,J1)*OMEGO*G3)**2+(DATAB(6,J1)*G3)**2
+DATAB(7,J1)**2+(DATAB(6,J1)/OMEGO)**2+AZ*AZ+(DATAB(12,J2)
*G2)**2+DDBZ*DDBZ)
IF (EX .LT. PHIRX .AND. EY .LT. PHIRY .AND. EZ .LT. PHIRZ)
F
T
GO TO 318
34
E9
J2=J2+1
IF (J2 .LE. J2E)
F
T
GO TO 314
32
E8
IPIC(2)=0
GO TO 308
31
E6
C ACCEPTABLE COMBINATION FOUND

CONT. ON PG 34

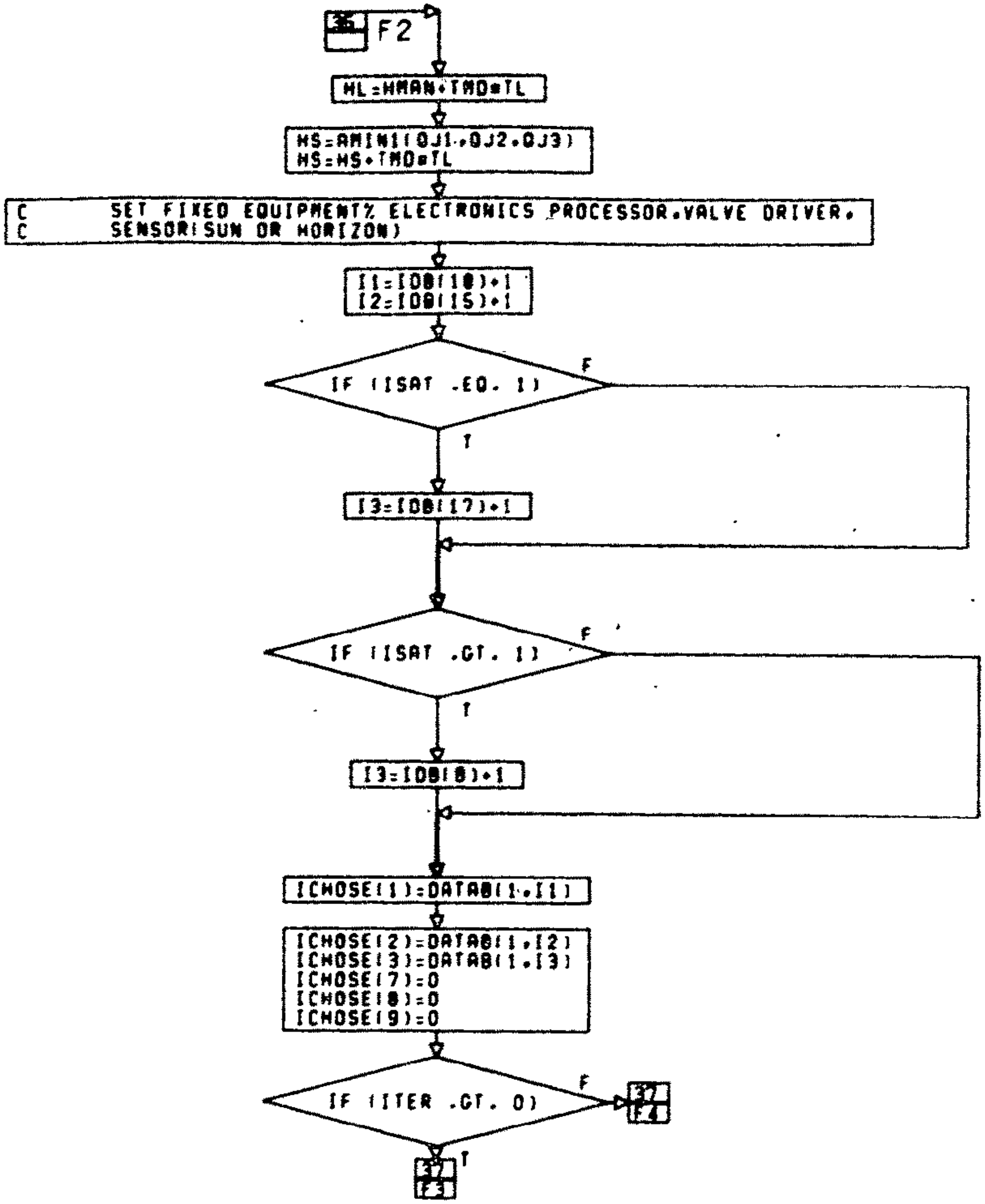
```
33  E9
318
ICHOSE(5)=DATAB(1,J2)

IPIC(2)=J2
WT=WT+DATAB(23,J2)*NCHOSE(5)+DATAB(23,J1)*NCHOSE(4)
VOL=VOL+DATAB(24,J2)*NCHOSE(5)+DATAB(24,J1)*NCHOSE(4)
PL=PL+DATAB(16,J2)*NCHOSE(5)+DATAB(16,J1)*NCHOSE(4)
PLMIN=PLMIN+DATAB(18,J2)*NCHOSE(5)+DATAB(18,J1)*NCHOSE(4)

XI=37000000.*TPRIM*DX*(FF*DI)**2/(XJ*DBX)
+2./57.3*.04*D*DPHI*FE*TSMALL/DX
+XNU*XJ*PDOTO/(57.3*DX)
+2.*XJ*PDOTX*XN/(57.3*DX)
+    (TAX*TAUXA + 2.592E6*TGX*T + TSX*TAUXS) / DX

YI=37000000.*TPRIM*DY*(FF*DI)**2/(YJ*DBY)
+(DPHI/57.3*DT+.04*D)*FE*TSMALL/DY
+XNU*YJ*PDOTO/(57.3*DY)
+2.*YJ*PDOTY*YN/(57.3*DY)
+    (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS) / DY

ZI=37000000.*TPRIM*DZ*(FF*DI)**2/(ZJ*DBZ)
+(DPHI/57.3*DT+.04*D)*FE*TSMALL/DZ
+XNU*ZJ*PDOTO/(57.3*DZ)
+2.*ZJ*PDOTZ*ZN/(57.3*DZ)
+    (TAZ*TAUZA + 2.592E6*TGZ*T + TSZ*TAUZS) / DZ

TI=XI+YI+ZI+FE*TSMALL
FC=14.1E-9*FF*DX*DI/(XJ*.4*PHIRX)
CLIFE = 37.E6 * TPRIM * FF * DX * DI / (XJ*.4*PHIRX)

RETURN

C       CONFIGURATION 4

13  F1
400
IERR=0

QJ1=XJ*PDOTX/57.3
QJ2=YJ*PDOTY/57.3
QJ3=ZJ*PDOTZ/57.3
HMAN=AMAX1(QJ1,QJ2,QJ3)
TMD=AMAX1(XMD2,YMD2,ZMD2)
HREQ=HMAN+86400.*TL*TMD
TREQ=HMAN/TACCEL+TMD

C       TEST IF ONLY 3-AXIS WHEELS OKAY

PDOTM=AMAX1(PDOTX,PDOTY,PDOTZ)
PDOTRM=AMIN1(PDOTRX,PDOTRY,PDOTRZ)
```

CONT. ON PG 35

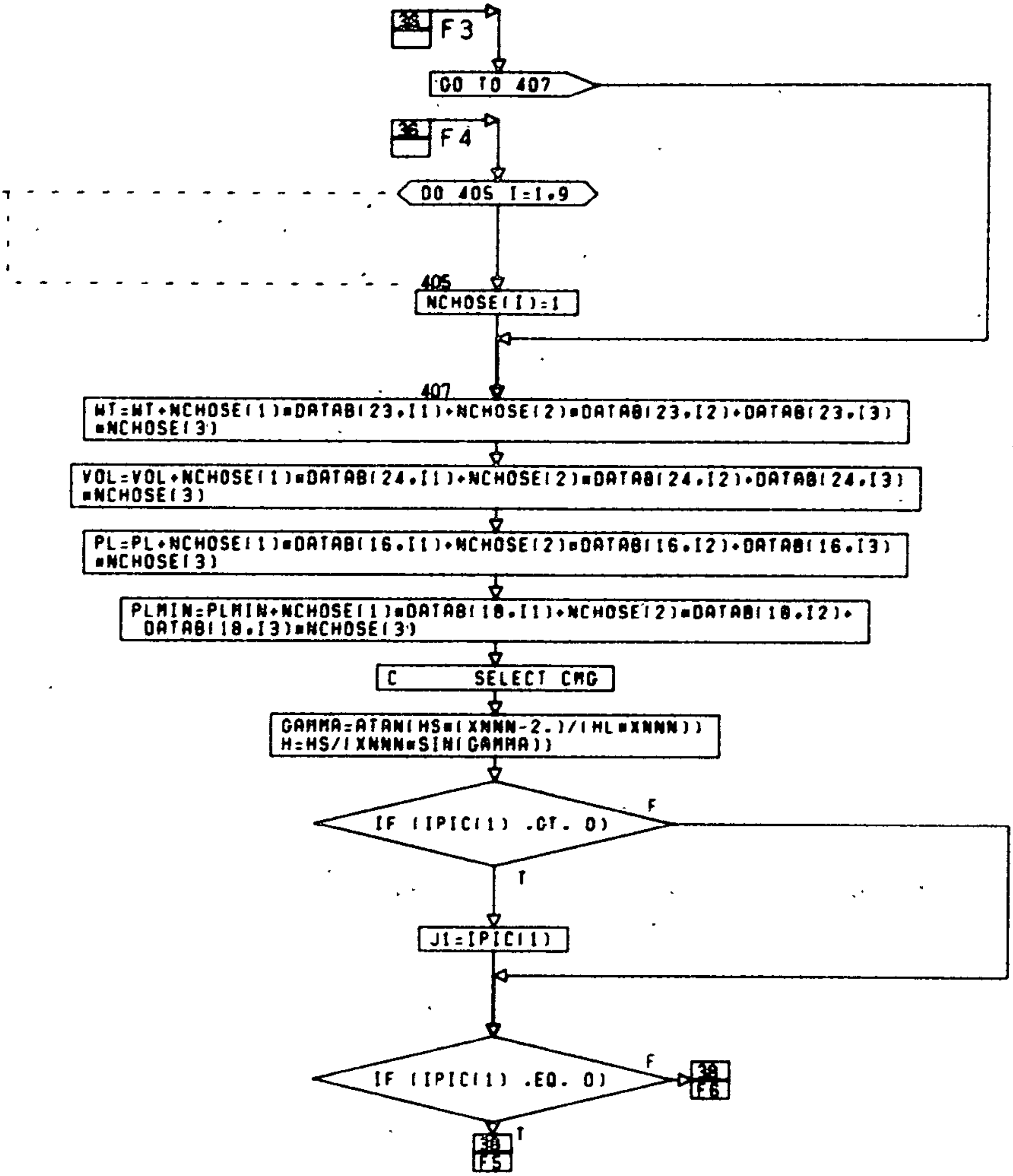


IF (TREQ/HREQ .GE. .02 .AND. .0000833*PDOTM .LT. PDOTRA)
F
T
GO TO 403
DO 402 I=1,9
402
ICHOSE(I)=-1
C TEST IF 3-AXIS ACCEPTABLE
C IERR % 1XX MEANS 3-AXIS WHEELS ACCEPTABLE
403
IF (TREQ/HREQ .LT. .1)
F
T
IERR=100
C IERR % 1XXX MEANS DOUBLE GIMBAL CMGTS ACCEPTABLE.
IF (TACCEL .LT. 20.)
F
36
F2
T
IERR=IERR+1000

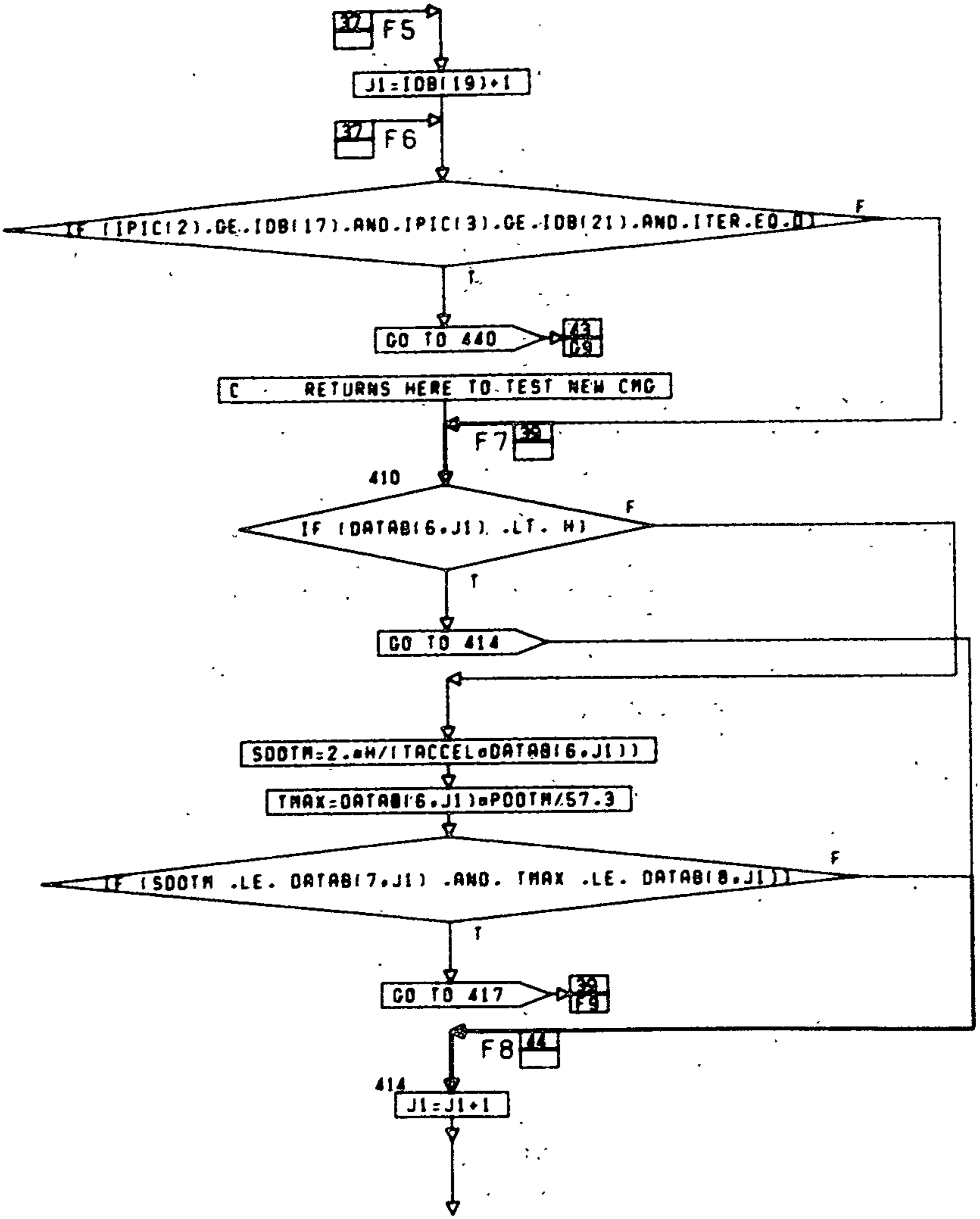
CONT. ON PG 36


36
F2
HL=HMAN+TMD*TL
HS=AMIN1(QJ1,QJ2,QJ3)
HS=HS+TMD*TL
C SET FIXED EQUIPMENT% ELECTRONICS PROCESSOR,VALVE DRIVER,
C SENSOR(SUN OR HORIZON)
I1=IDB(10)+1
I2=IDB(15)+1
IF (ISAT .EQ. 1)
F
T
I3=IDB(17)+1
IF (ISAT .GT. 1)
F
T
I3=IDB(8)+1
ICHOSE(1)=DATAB(1,I1)
ICHOSE(2)=DATAB(1,I2)
ICHOSE(3)=DATAB(1,I3)
ICHOSE(7)=0
ICHOSE(8)=0
ICHOSE(9)=0
IF (ITER .GT. 0)
F
37
F4
T
37
F3

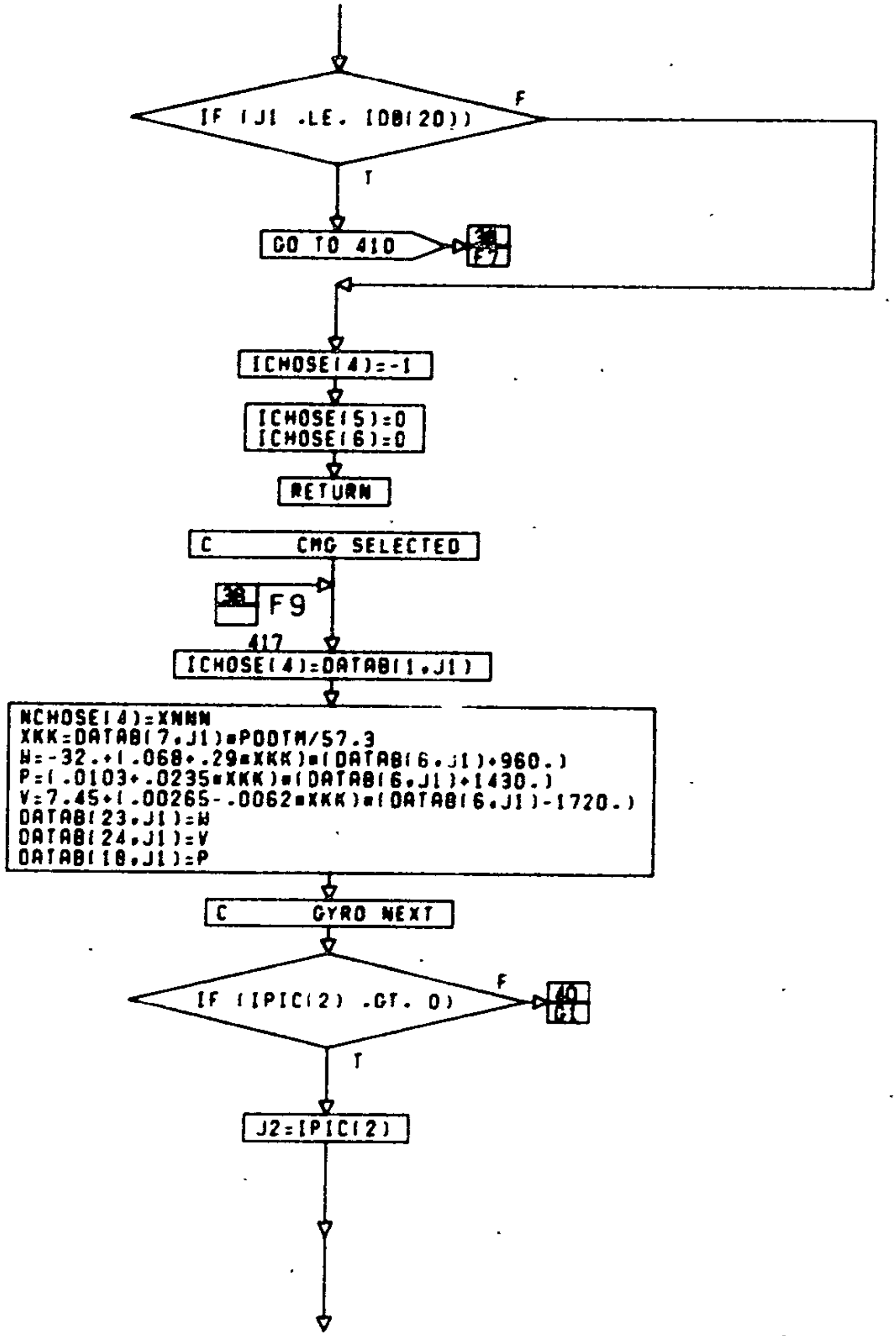
CONT. ON PG 37


36
F3
GO TO 407
36
F4
DO 405 I=1,9
405
NCHOSE(I)=1
407
WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)+DATAB(23,I3)
*NCHOSE(3)
VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)+DATAB(24,I3)
*NCHOSE(3)
PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)+DATAB(16,I3)
*NCHOSE(3)
PLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)+
DATAB(18,I3)*NCHOSE(3)
C SELECT CMG
GAMMA=ATAN(HS*(XNNN-2.)/(HL*XNNN))
H=HS/(XNNN*SIN(GAMMA))
IF (IPIC(1) .GT. 0)
F
T
J1=IPIC(1)
IF (IPIC(1) .EQ. 0)
F
38
F6
T
38
F5

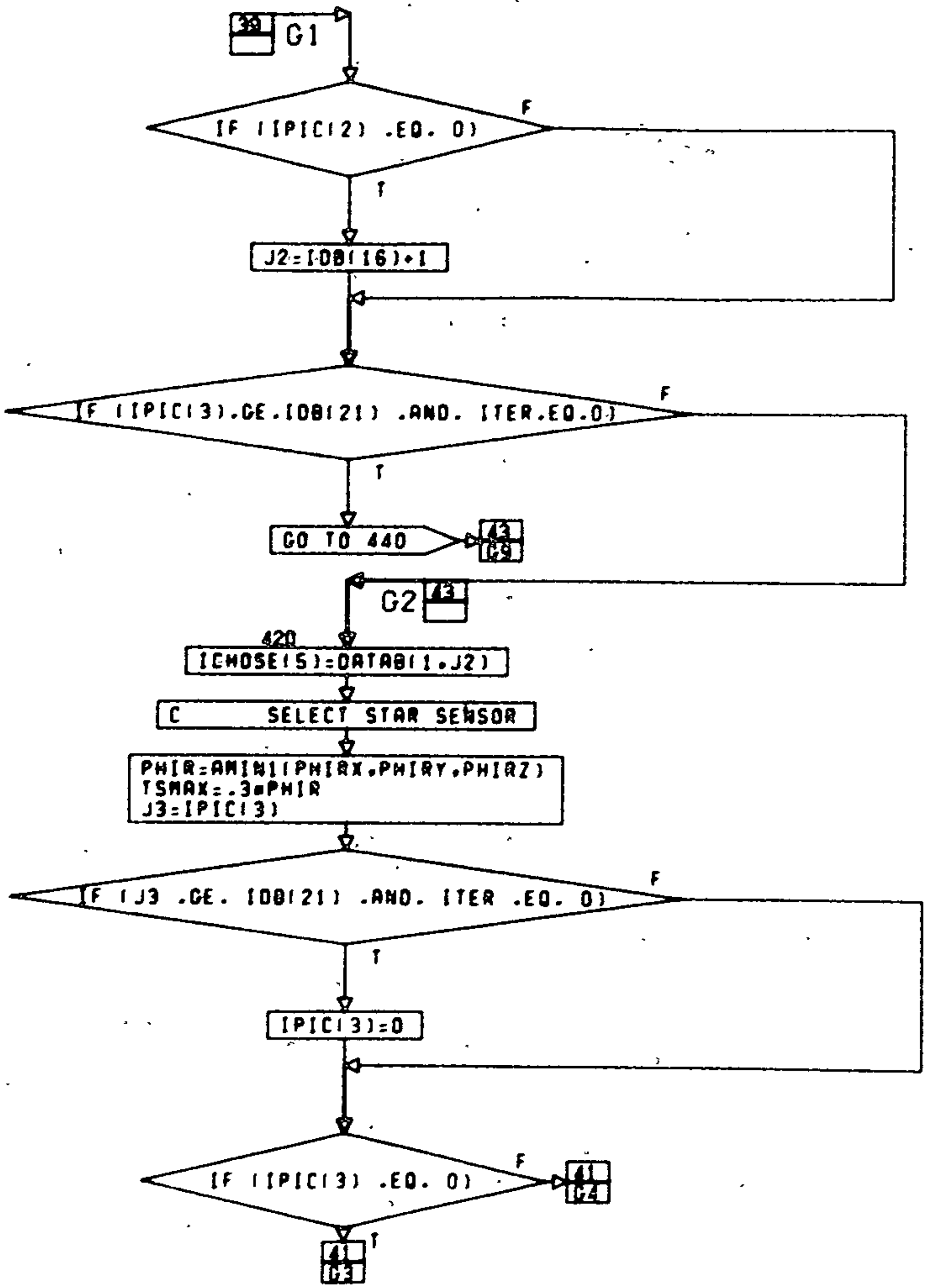
CONT. ON PG 38


37
F5
J1=IDB(19)+1
37
F6
IF (IPIC(2).GE.IDB(17).AND.IPIC(3).GE.IDB(21).AND.ITER.EQ.0)
F
T
GO TO 440
43
C9
C   RETURNS HERE TO TEST NEW CMG
F7
39
410
IF (DATAB(6,J1) .LT. H)
F
T
GO TO 414
SDOTM=2.*H/(TACCEL*DATAB(6,J1))
TMAX=DATAB(6,J1)*PDOTM/57.3
IF (SDOTM .LE. DATAB(7,J1) .AND. TMAX .LE. DATAB(8,J1))
F
T
GO TO 417
39
F9
F8
44
414
J1=J1+1

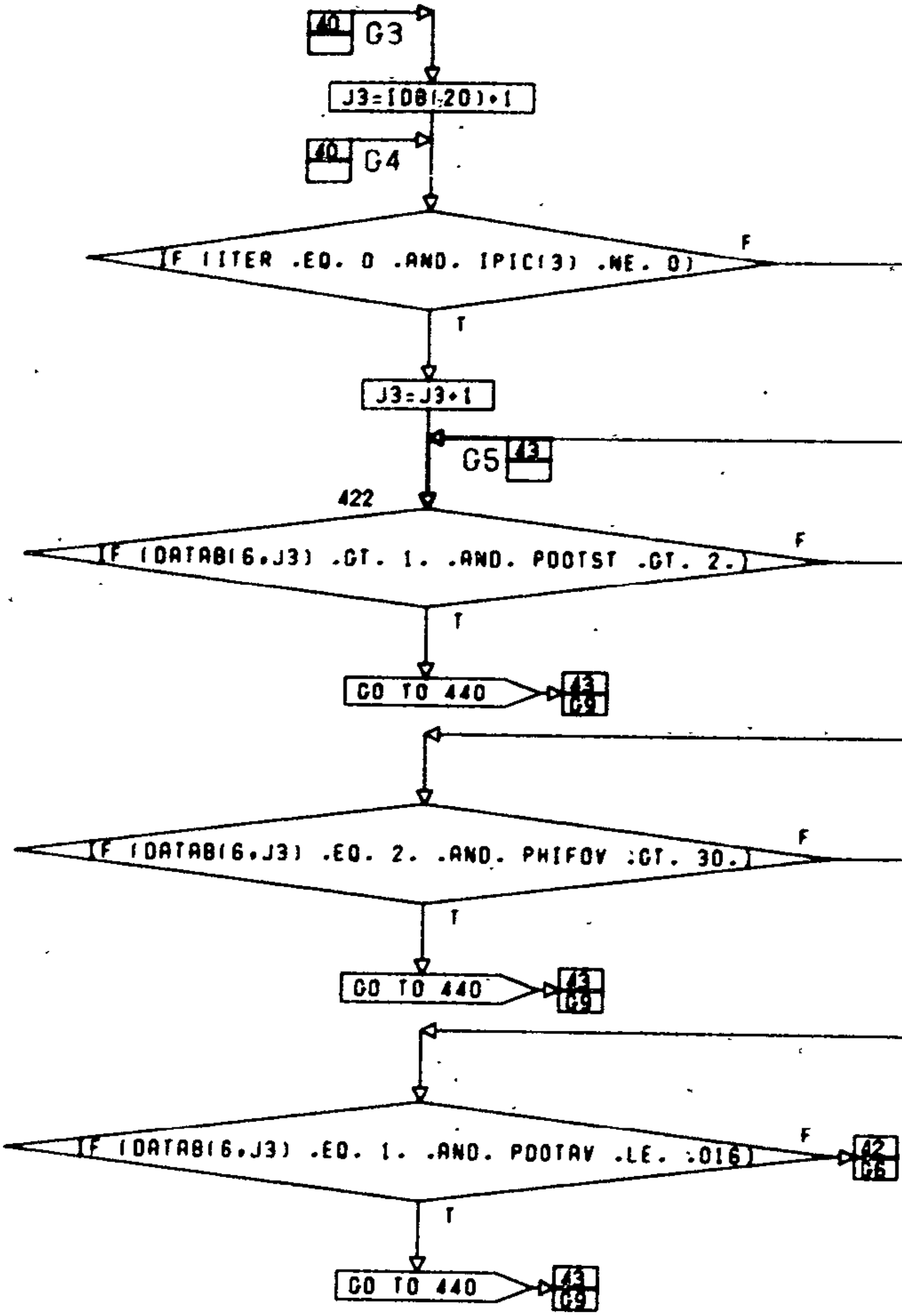
CONT. ON PG 39


IF (J1 .LE. IDB(20))
F
T
GO TO 410
38
F7
ICHOSE(4)=-1
ICHOSE(5)=0
ICHOSE(6)=0
RETURN
C CMG SELECTED
38
F9
417
ICHOSE(4)=DATAB(1,J1)
NCHOSE(4)=XNNN
XKK=DATAB(7,J1)*PODTM/57.3
W=-32.+(.068+.29*XKK)*(DATAB(6,J1)+960.)
P=(.0103+.0235*XKK)*(DATAB(6,J1)+1430.)
V=7.45+(.00265-.0062*XKK)*(DATAB(6,J1)-1720.)
DATAB(23,J1)=W
DATAB(24,J1)=V
DATAB(18,J1)=P
C GYRO NEXT
IF (IPIC(2) .GT. 0)
F
40
G1
T
J2=IPIC(2)

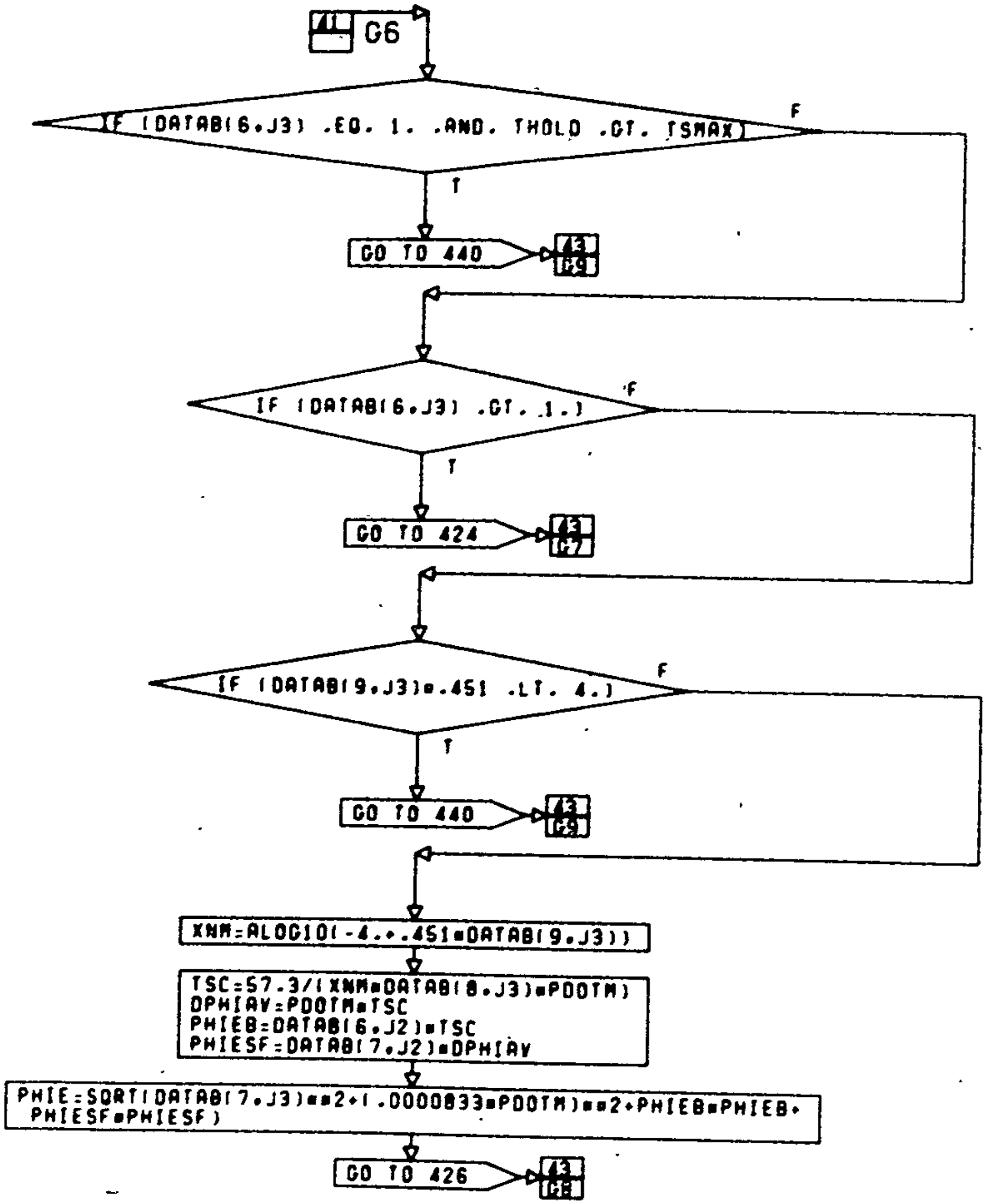
CONT. ON PG 40


39
G1
IF (IPIC(2) .EQ. 0)
F
T
J2=IDB(16)+1
IF (IPIC(3).GE.IDB(21) .AND. ITER.EQ.0)
F
T
GO TO 440
43
G9
G2
43
420
ICHOSE(5)=DATAB(1,J2)
C SELECT STAR SENSOR
PHIR=AMIN1(PHIRX,PHIRY,PHIRZ)
TSMAX=.3*PHIR
J3=IPIC(3)
IF (J3 .GE. IDB(21) .AND. ITER .EQ. 0)
F
T
IPIC(3)=0
IF (IPIC(3) .EQ. 0)
F
41
G4
T
41
G3

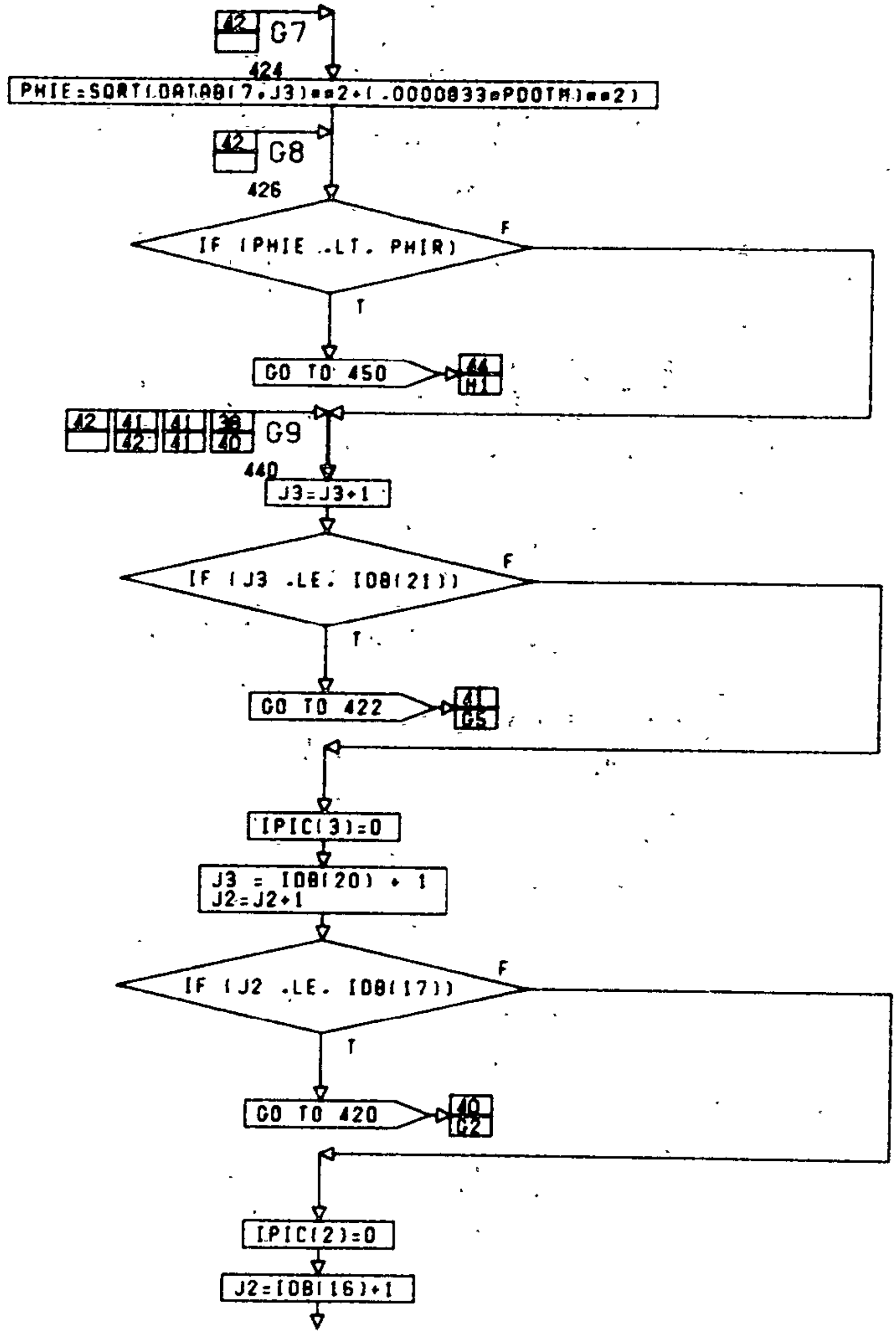
CONT. ON PG 41


40
G3
J3=IDB(20)+1
40
G4
IF (ITER .EQ. 0 .AND. IPIC(3) .NE. 0)
F
T
J3=J3+1
G5
43
422
IF (DATAB(6,J3) .GT. 1. .AND. PDOTST .GT. 2.)
F
T
GO TO 440
43
G9
IF (DATAB(6,J3) .EQ. 2. .AND. PHIFOV .GT. 30.)
F
T
GO TO 440
43
G9
IF (DATAB(6,J3) .EQ. 1. .AND. PDOTAV .LE. .016)
F
42
G6
T
GO TO 440
43
G9

CONT. ON PG 42


41
G6
IF (DATAB(6,J3) .EQ. 1. .AND. THOLD .GT. TSMAX)
F
T
GO TO 440
43
G9
IF (DATAB(6,J3) .GT. 1.)
F
T
GO TO 424
43
G7
IF (DATAB(9,J3)*.451 .LT. 4.)
F
T
GO TO 440
43
G9
XNM=ALOG10(-4.+.451*DATAB(9,J3))
TSC=57.3/(XNM*DATAB(8,J3)*PDOTM)
DPHIAV=PDOTM*TSC
PHIEB=DATAB(6,J2)*TSC
PHIESF=DATAB(7,J2)*DPHIAV
PHIE=SQRT(DATAB(7,J3)**2+(.0000833*PDOTM)**2+PHIEB*PHIEB+
PHIESF*PHIESF)
GO TO 426
43
G8

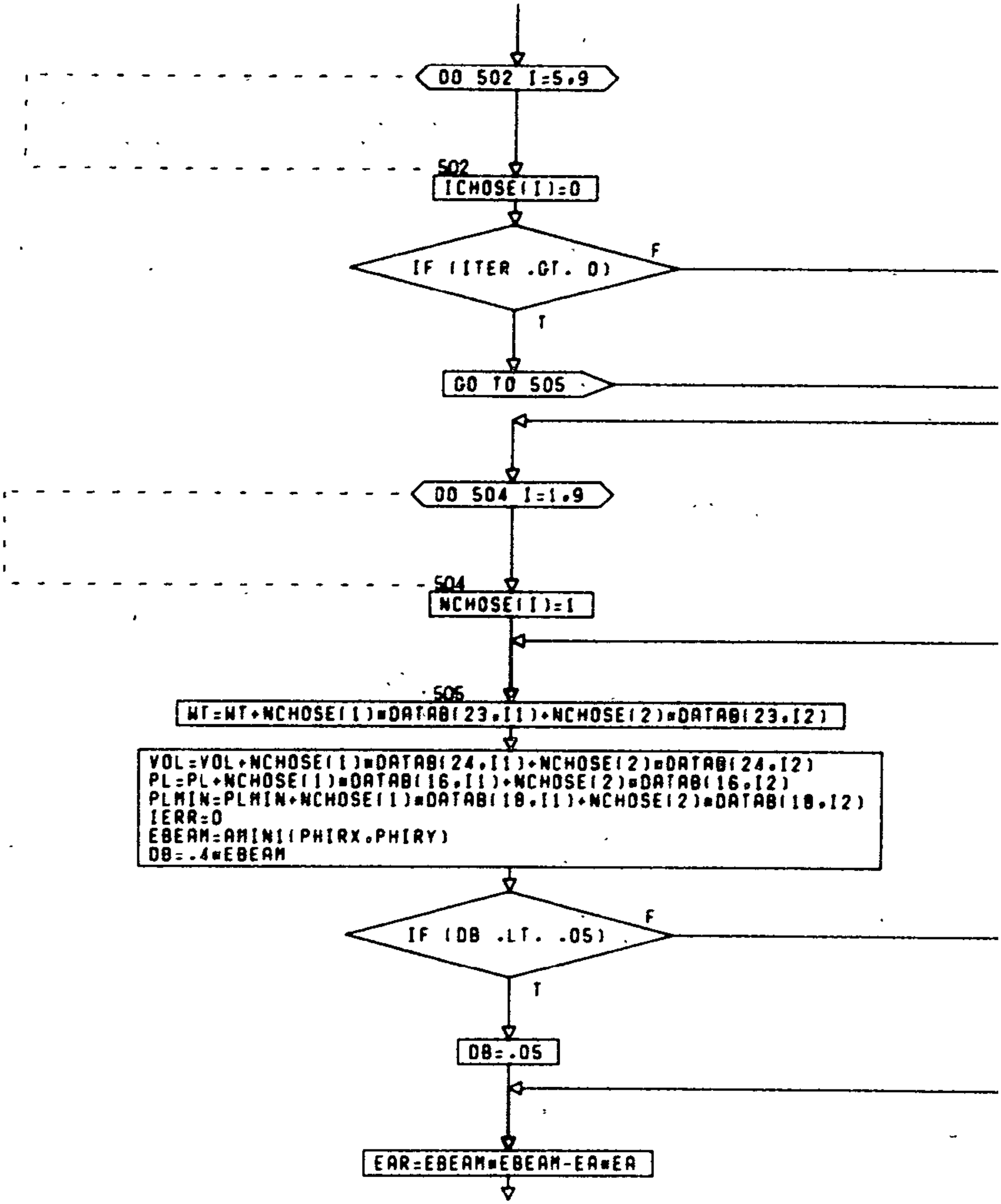
CONT. ON PG 43


42
G7
424
PHIE=SQRT(DATAB(7,J3)**2+(.0000833*PDOTM)**2)
42
G8
426
IF (PHIE .LT. PHIR)
F
T
GO TO 450
44
H1
42
41
42
41
41
38
40
G9
440
J3=J3+1
IF (J3 .LE. IDB(21))
F
T
GO TO 422
41
G5
IPIC(3)=0
J3 = IDB(20) + 1
J2=J2+1
IF (J2 .LE. IDB(17))
F
T
GO TO 420
40
G2
IPIC(2)=0
J2=IDB(16)+1

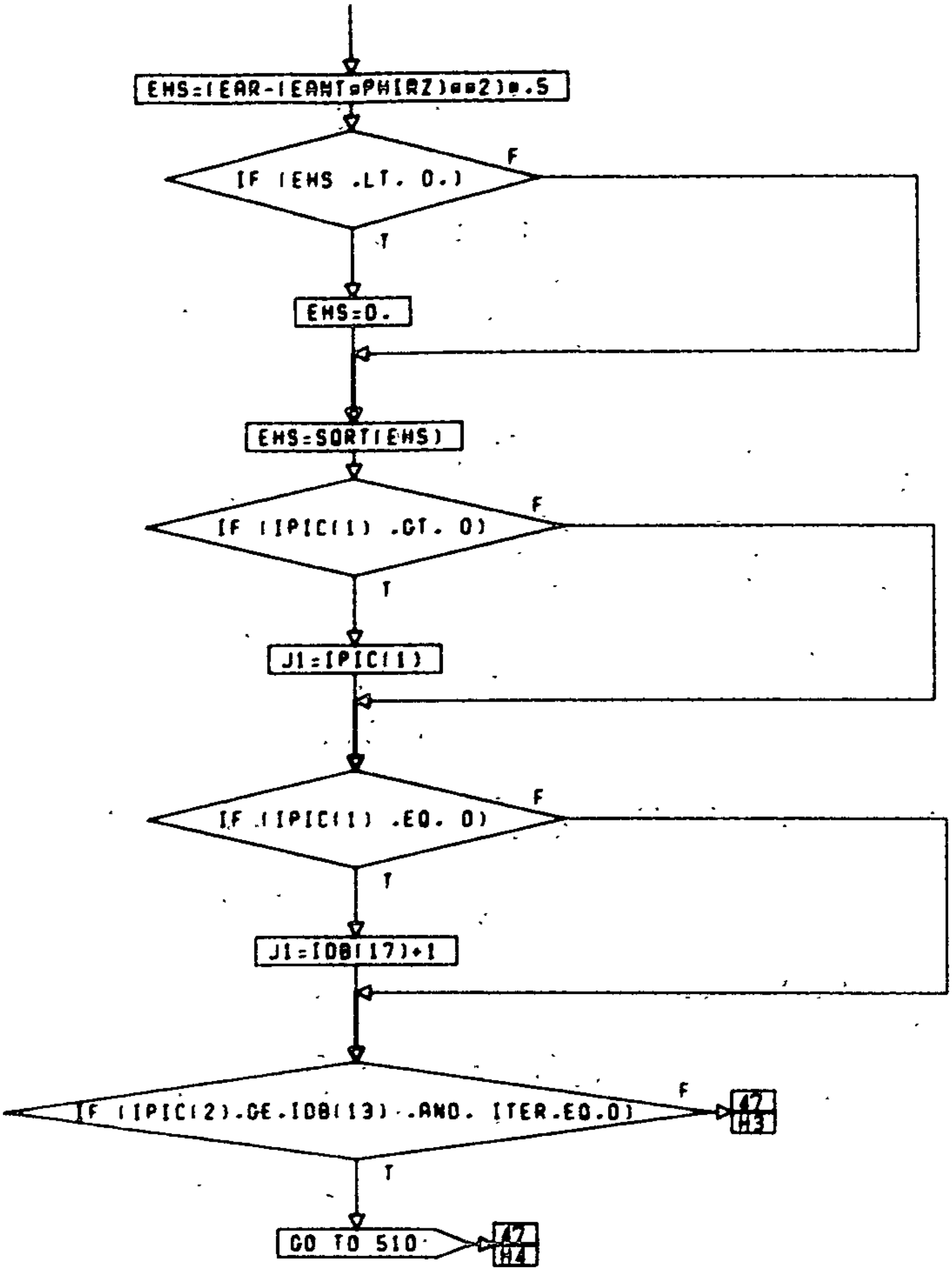
CONT. ON PG 44

```
GO TO 414                                            34
                                                     F8

C       ACCEPTABLE COMBINATION FOUND

43  H1

450
ICHOSE(6)=DATAB(1,J3)

IPIC(1)=J1
IPIC(2)=J2
IPIC(3)=J3
WT=WT+W*XNNN+NCHOSE(5)*DATAB(23,J2)+NCHOSE(6)*DATAB(23,J3)
VOL=VOL+V*XNNN+NCHOSE(5)*DATAB(24,J2)+NCHOSE(6)*DATAB(24,J3)
PL=PL+P*XNNN+NCHOSE(5)*DATAB(16,J2)+NCHOSE(6)*DATAB(16,J3)

PLMIN=PLMIN+DATAB(18,J1)*XNNN+NCHOSE(5)*DATAB(18,J2)+NCHOSE(6)*
 DATAB(18,J3)

C       NOW THRUST AND IMPULSE

F(1)=(DPHI*DT/57.3+.04*D)*FE/DY
F(2)=(DPHI*DT/57.3+.04*D)*FE/DZ
F(3)=2./57.3*.04*D*DPHI*FE/DX
FF=AMAX1(F(1),F(2),F(3))

TI=(F(1)+F(2)+F(3))*TSMALL
 +XNU*PDOTO/57.3*(XJ/DX+YJ/DY+ZJ/DZ)
 +     (TAX*TAUXA + 2.592E6*TGX*T + TSX*TAUXS) / DX
 +     (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS) / DY
 +     (TAZ*TAUZA + 2.592E6*TGZ*T + TSZ*TAUZS) / DZ
 +FE*TSMALL

FC=FF*DX*DI/(XJ*.4*PHIRX)*14.1E-9
CLIFE = 37.E6 * TPRIM * FF * DX * DI / (XJ*.4*PHIRX)

RETURN

C       CONFIGURATION 5
C       SELECT FIXED EQUIPMENT

13  H2

500
I1=IDB(15)+1

I2=IDB(21)+1
ICHOSE(1)=DATAB(1,I1)
ICHOSE(2)=DATAB(1,I2)
```

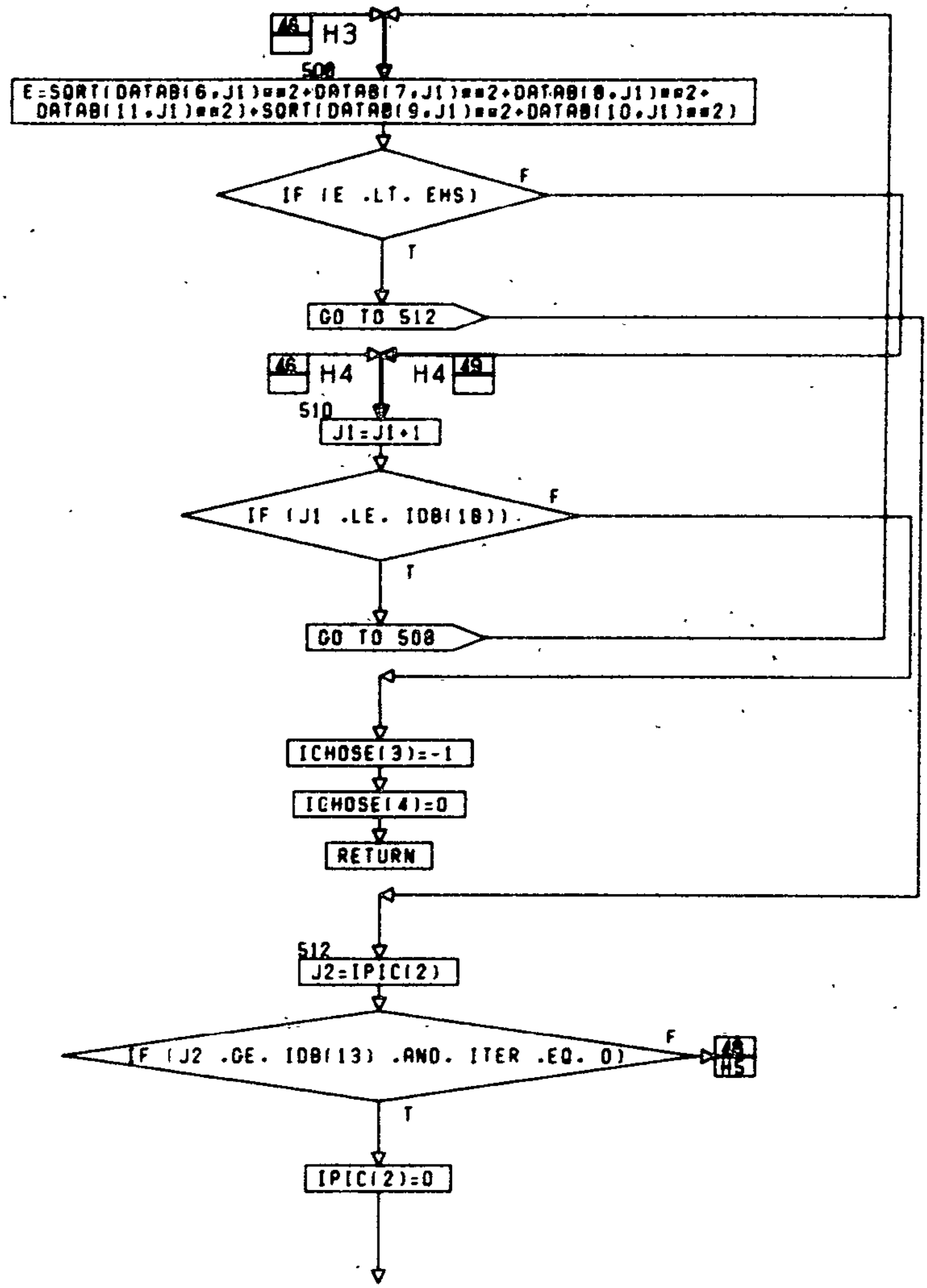
CONT. ON PG 45


DO 502 I=5,9
502
ICHOSE(I)=0
IF (ITER .GT. 0)
F
T
GO TO 505
DO 504 I=1,9
504
NCHOSE(I)=1
505
WT=WT+NCHOSE(1)*DATAB(23,I1)+NCHOSE(2)*DATAB(23,I2)
VOL=VOL+NCHOSE(1)*DATAB(24,I1)+NCHOSE(2)*DATAB(24,I2)
PL=PL+NCHOSE(1)*DATAB(16,I1)+NCHOSE(2)*DATAB(16,I2)
PLMIN=PLMIN+NCHOSE(1)*DATAB(18,I1)+NCHOSE(2)*DATAB(18,I2)
IERR=0
EBEAM=AMIN1(PHIRX,PHIRY)
DB=.4*EBEAM
IF (DB .LT. .05)
F
T
DB=.05
EAR=EBEAM*EBEAM-EA*EA

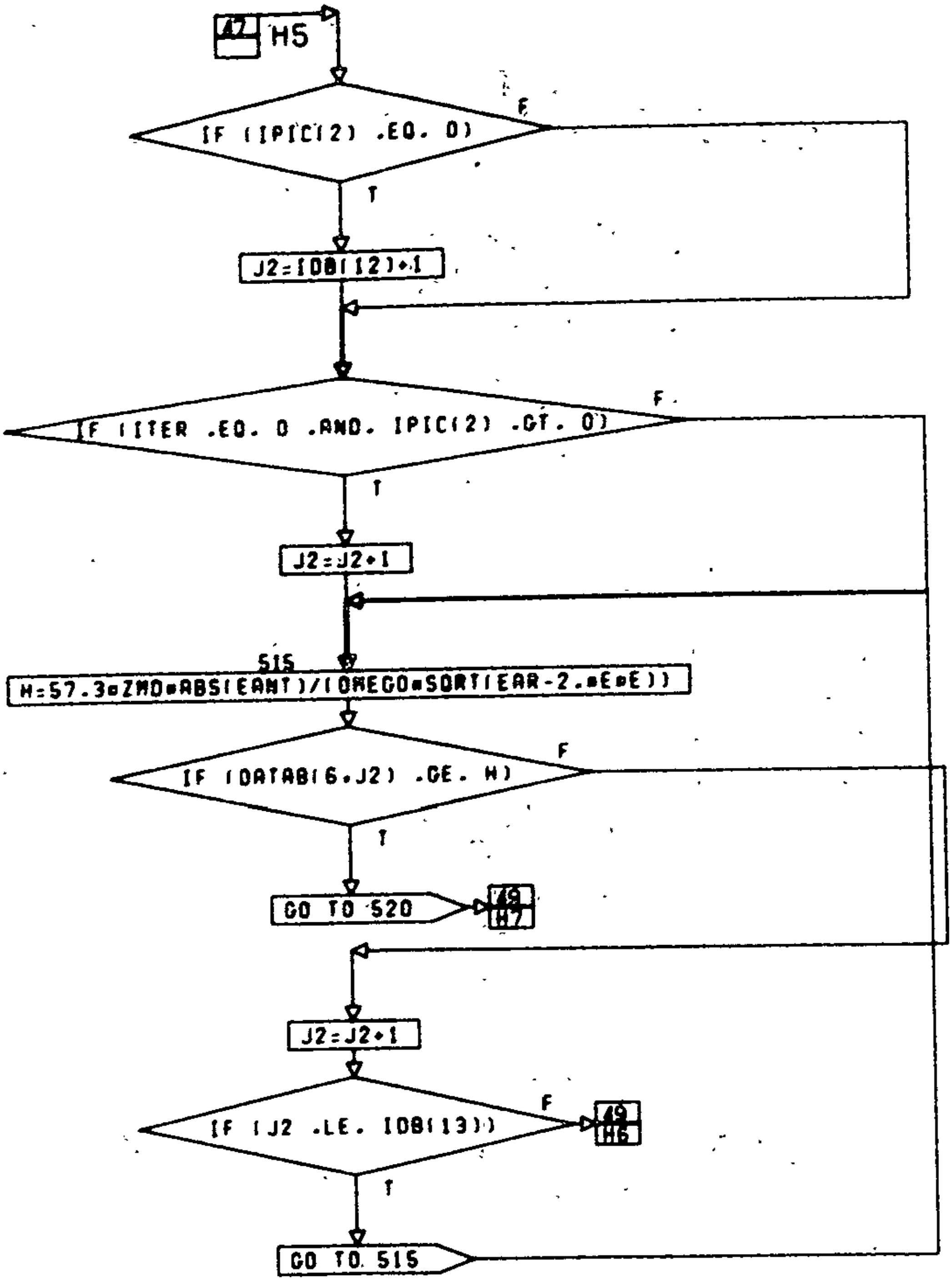
CONT. ON PG 46


EHS=(EAR-(EANT*PH(RZ)**2)*.5
IF (EHS .LT. 0.)
F
T
EHS=0.
EHS=SQRT(EHS)
IF (IPIC(1) .GT. 0)
F
T
J1=IPIC(1)
IF (IPIC(1) .EQ. 0)
F
T
J1=IDB(17)+1
IF (IPIC(2).GE.IDB(13) .AND. ITER.EQ.0)
F
47
H3
T
GO TO 510
47
H4

CONT. ON PG 47

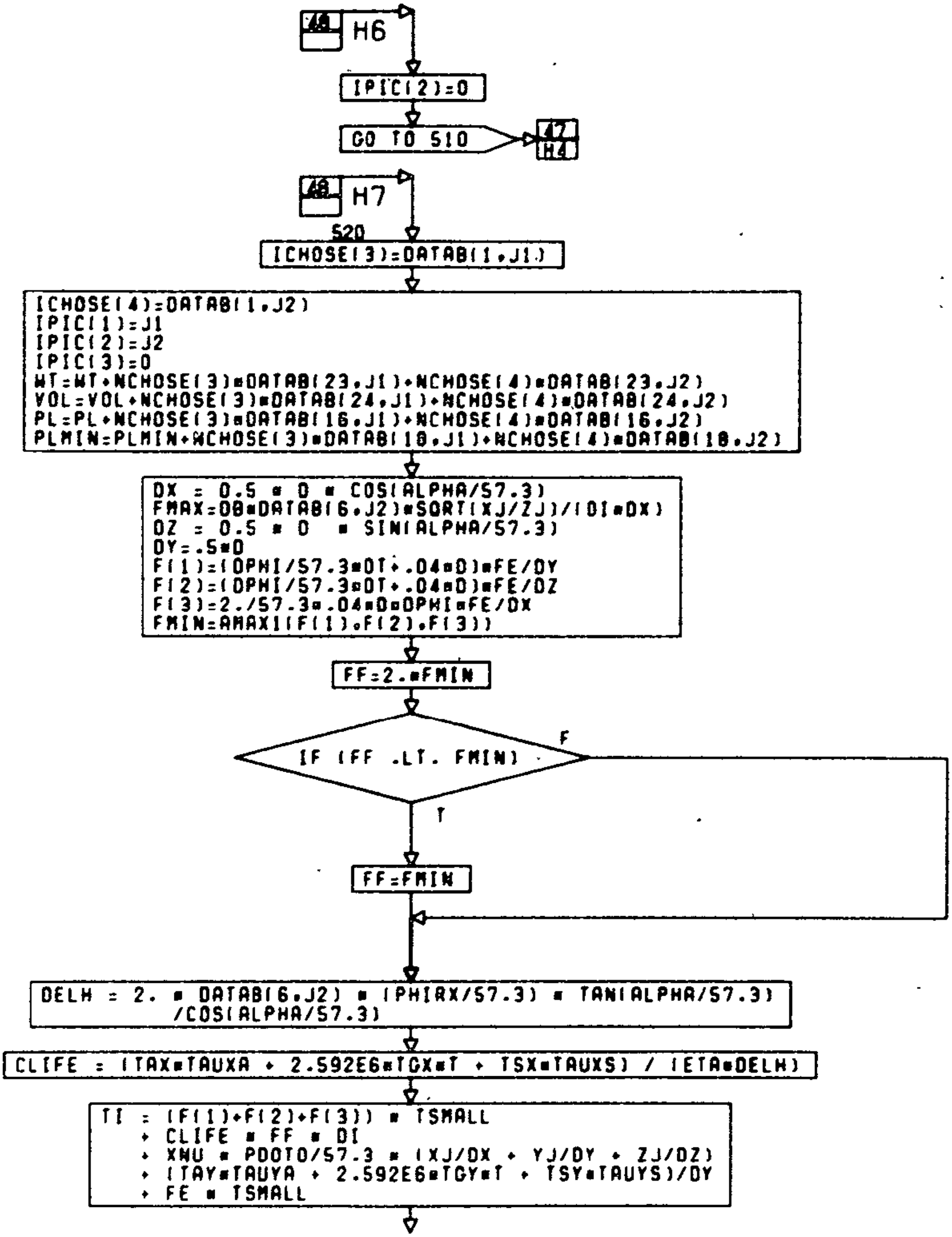

46
H3
508
E=SQRT(DATAB(6,J1)**2+DATAB(7,J1)**2+DATAB(8,J1)**2+
DATAB(11,J1)**2)+SQRT(DATAB(9,J1)**2+DATAB(10,J1)**2)
IF (E .LT. EHS)
F
T
GO TO 512
46
H4
H4
49
510
J1=J1+1
IF (J1 .LE. IDB(18))
F
T
GO TO 508
ICHOSE(3)=-1
ICHOSE(4)=0
RETURN
512
J2=IPIC(2)
IF (J2 .GE. IDB(13) .AND. ITER .EQ. 0)
F
48
H5
T
IPIC(2)=0

CONT. ON PG 48



47
H5
IF (IPIC(2) .EQ. 0)
F
T
J2=IDB(12)+1
IF (ITER .EQ. 0 .AND. IPIC(2) .GT. 0)
F
T
J2=J2+1
515
H=57.3*ZMD*ABS(EANT)/(OMEGO*SQRT(EAR-2.*E*E))
IF (DATAB(6,J2) .GE. H)
F
T
GO TO 520
49
H7
J2=J2+1
IF (J2 .LE. IDB(13))
F
49
H6
T
GO TO 515

CONT. ON PG 49


48
H6
IPIC(2)=0
GO TO 510
47
H4
48
H7
520
ICHOSE(3)=DATAB(1,J1)
ICHOSE(4)=DATAB(1,J2)
IPIC(1)=J1
IPIC(2)=J2
IPIC(3)=0
WT=WT+NCHOSE(3)*DATAB(23,J1)+NCHOSE(4)*DATAB(23,J2)
VOL=VOL+NCHOSE(3)*DATAB(24,J1)+NCHOSE(4)*DATAB(24,J2)
PL=PL+NCHOSE(3)*DATAB(16,J1)+NCHOSE(4)*DATAB(16,J2)
PLMIN=PLMIN+NCHOSE(3)*DATAB(18,J1)+NCHOSE(4)*DATAB(18,J2)
DX = 0.5 * D * COS(ALPHA/57.3)
FMAX=DB*DATAB(6,J2)*SQRT(XJ/ZJ)/(DI*DX)
DZ = 0.5 * D * SIN(ALPHA/57.3)
DY=.5*D
F(1)=(DPHI/57.3*DT+.04*D)*FE/DY
F(2)=(DPHI/57.3*DT+.04*D)*FE/DZ
F(3)=2./57.3*.04*D*DPHI*FE/DX
FMIN=AMAX1(F(1),F(2),F(3))
FF=2.*FMIN
IF (FF .LT. FMIN)
F
T
FF=FMIN
DELH = 2. * DATAB(6,J2) * (PHIRX/57.3) * TAN(ALPHA/57.3)
/COS(ALPHA/57.3)
CLIFE = (TAX*TAUXA + 2.592E6*TGX*T + TSX*TAUXS) / (ETA*DELH)
TI = (F(1)+F(2)+F(3)) * TSMALL
+ CLIFE * FF * DI
+ XNU * PDOTO/57.3 * (XJ/DX + YJ/DY + ZJ/DZ)
+ (TAY*TAUYA + 2.592E6*TGY*T + TSY*TAUYS)/DY
+ FE * TSMALL

CONT. ON PG 50

FC = 1.3889E-12 * CLIFE /T

RETURN

END

PG 50 FINAL

```
SUBROUTINE STRUCT(NCONF)
DIMENSION NCONF(6)
COMMON /USER9/          CA,          CE
```

```
COMMON /USER1/    APOGEE,    COMRAT,    DIAMAX,  EEQWT(9),    EPME,
                  EQM1WT,    EQM1XL,    EQM1YL,    EQM1ZL,    EQM2WT,
                  EQM2XL,    EQM2YL,    EQM2ZL,        FE,    IAGNCY,
        IDEBUG,   ISATOR,    MB12SH,    OPTEMP,    ORBINC,    PERIGE,
         MICRO,    RELME,   SPEC(8),     SPEC1,     XDUM1,    XCGSA1,
                    XMER,      XMEU
```

```
COMMON /BTWN/      ACSSN,     ACSWP,       ALT,      AREA,    BATCAP,
               BITRAT(2),     CLIFE,    CONVWT,    SATDAM,        DT,
                      DX,        DY,        DZ,     EQBLG,    EQBSID,
                      FC,        FF,    HARNWT,       HPT,    HTPIPE,
                    HTPT,    HTRPRB,    HTRPWR,               IBTLOC,
                   LMBDD,        NC,    OMEGS,    PASSTR,        PJ,
                      PL,     PLMIN,    POCNWT,      RADA,     RADAB,
                     RAT,        RJ,    SABOLG,     SATLG,    SATTWT,
```

```
                   SATWT,    SATXCG,    SATYCG,    SATZCG,    SA1XL,
                   SA1YL,     SA1ZL,      SIDE,     SYSLB,    THCMWT,
               THRUST(2),        TI,     TNKWT,     TPRIM,        VB,
                    VCHP,       VOL,    SOARWT,        WB,       WBT,
                      WT,        XJ,    XNZERO,        YJ,        ZJ
```

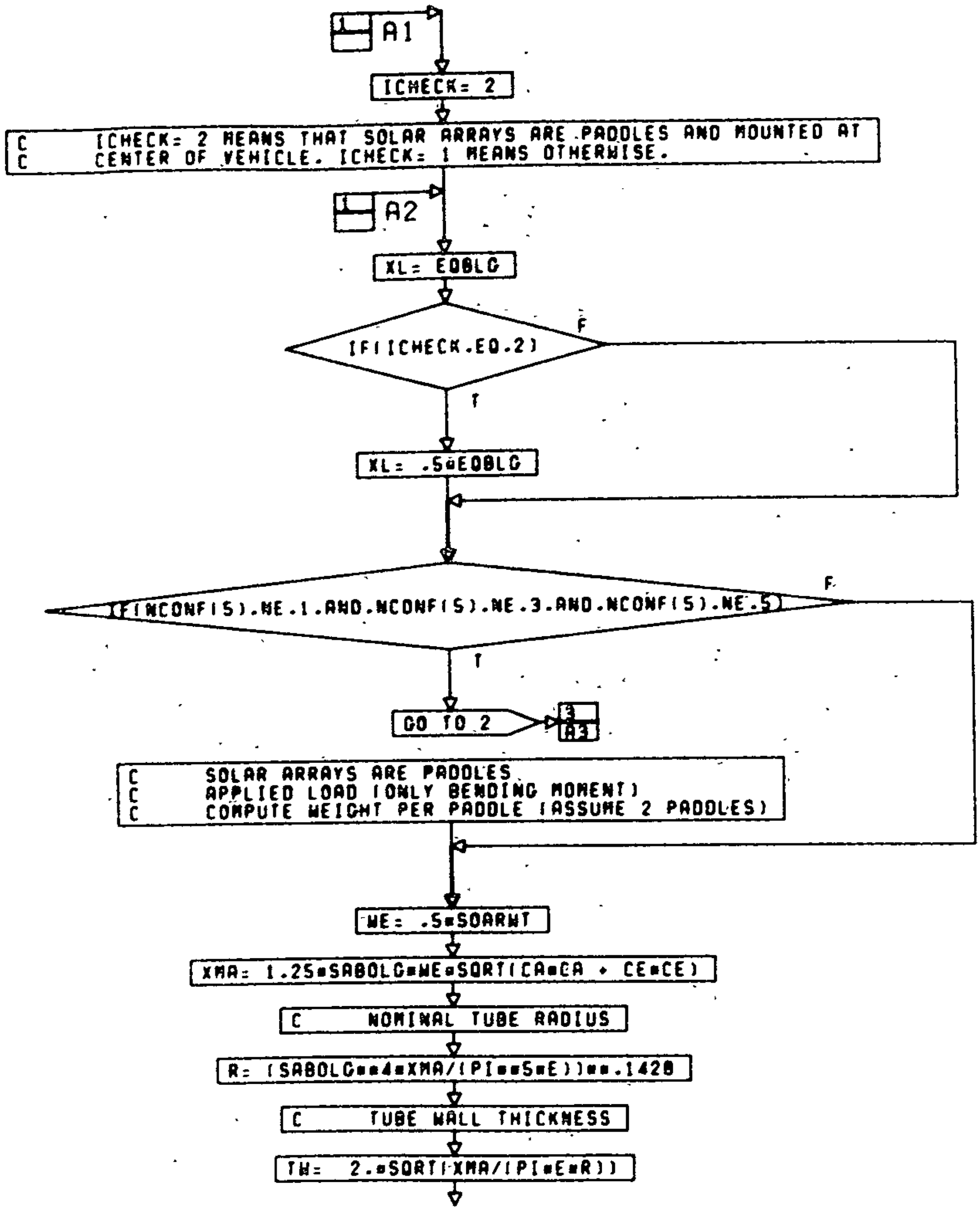
```
COMMON/PRTCOM/    ACCRCY,        AM,        AN,        BF,        BS,
              COPI(7,2),    CISTAR,      CTOT,      DOTE,        DE,
                   DRIWT,    EOBSTR,    FEEINV,    FEEOPS,      FEER,
                     GSE,      IREL,    ITRUNC,  MMDOLD,NAME(3,60),
                     OPS,    PAYINV,    PAYOUL,      PAYR,        PE,
                     PMP,       PMR,  POWER(6),        PU,    PWR(60),
                     OCP,       OCR,  ROLD(60),    SABMWT,    SATAOP,
                  SATINV,      SATR,      SEIP,      SEIR,  SKTAU(6),
```

```
               SSREL(6),   SUBE(7),   SUBT(7),  SUBUE(7),  SUBUP(7),
                      TA,  TAU(6,6),        TB,        TC,        TE,
                      TF,     TOOLR,     TOOLU,    TOTOPS,     TRUNC,
                      TS,        T,VOLUME(6),    VOL(60),WEIGHT(6),
                   XLTOT,      XMEH,    XMEINV,      XMEL,     XMEVL,
                    XMEW,     XMEWT,     XVEST
```

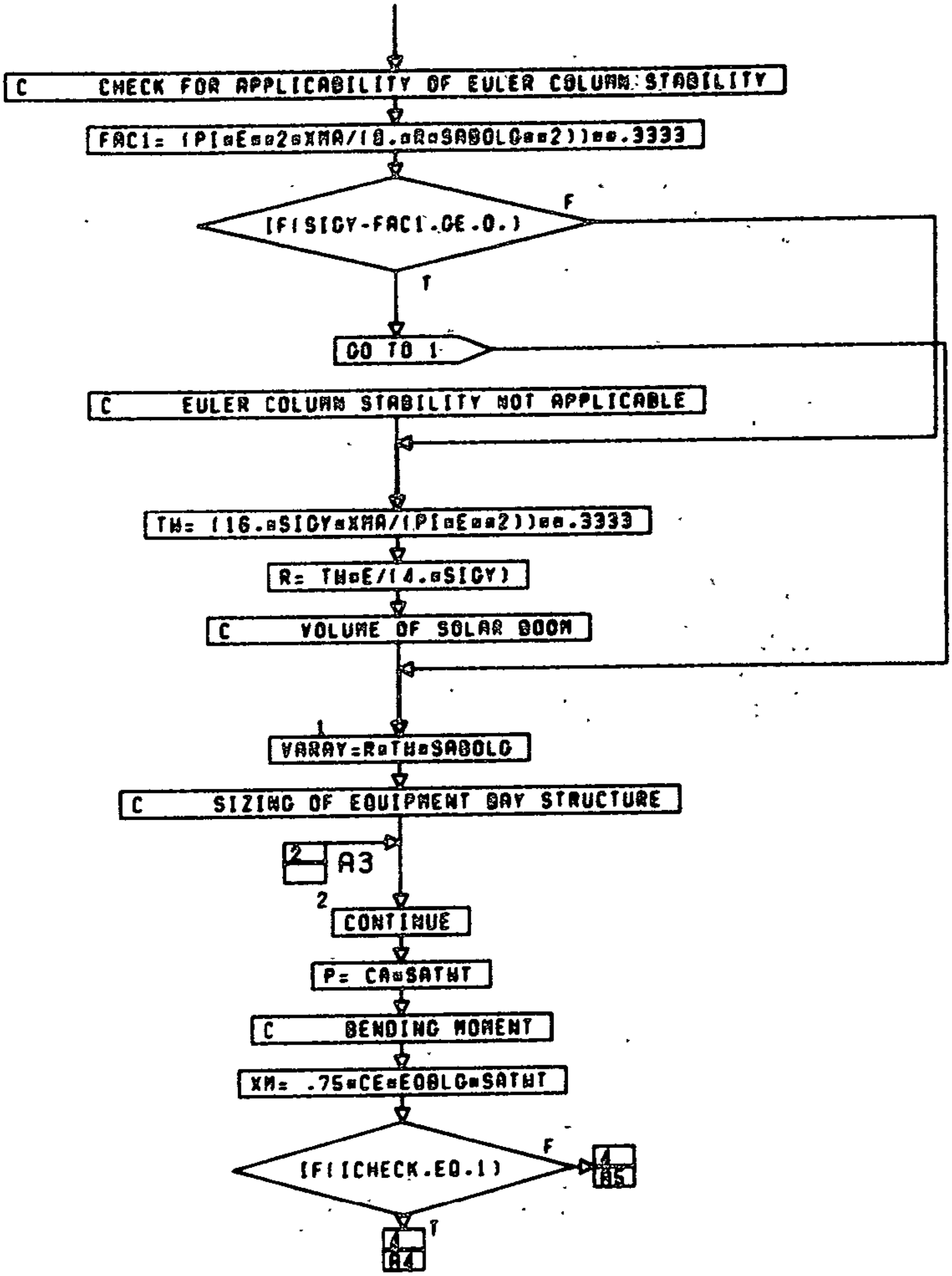
```
DATA E,XNU,SIGY,PI/1.E7,.33,3.E4,3.1416/
TB= 0.
XXNU= 1. - XNU**2
VARAY=0.
ICHECK= 1
```

```
2
A2
F
IF((NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5).AND.
XCGSA1.EQ.2)
T
2
A1
```

CONT. ON PG 2

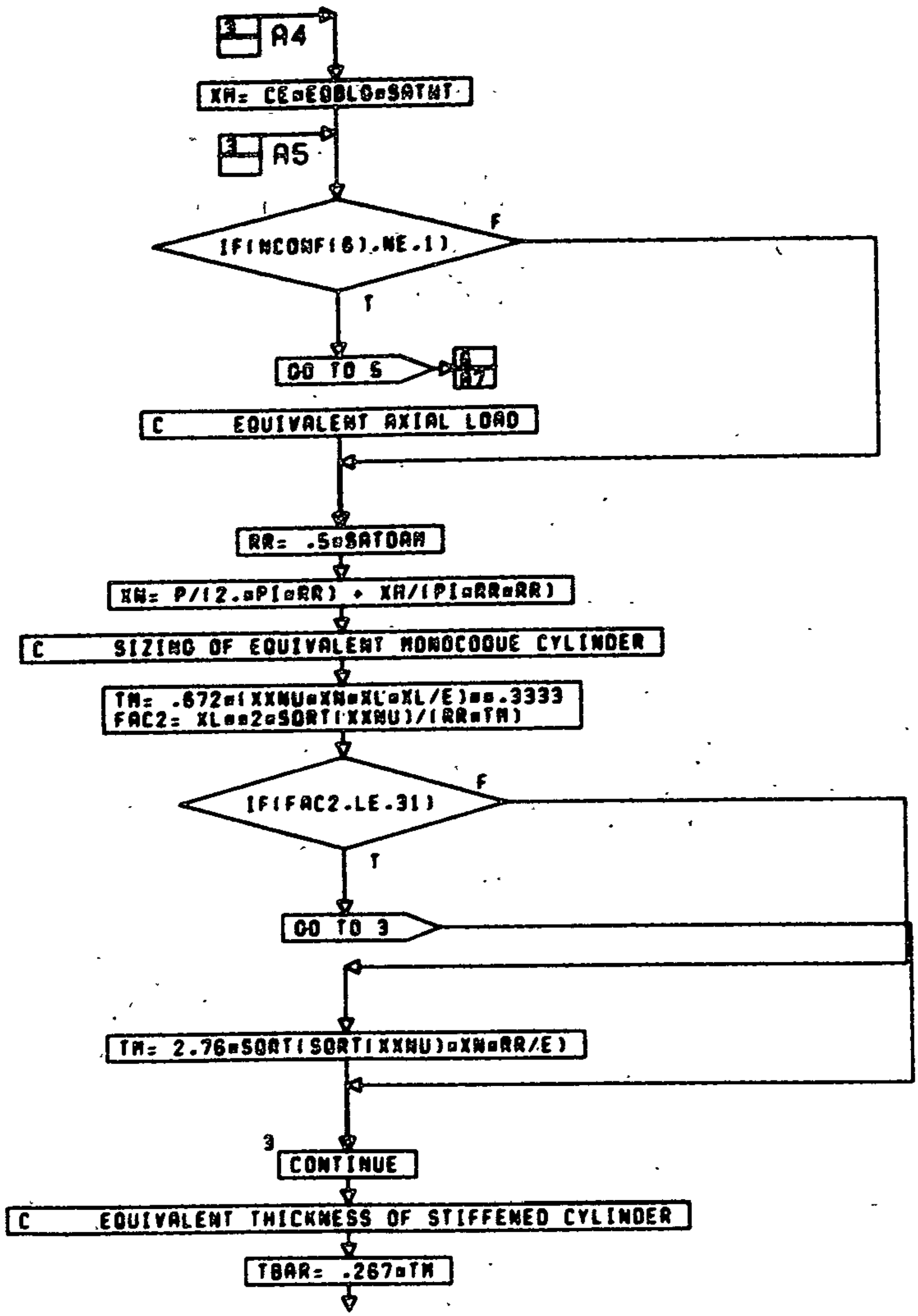

A1
ICHECK= 2
C ICHECK= 2 MEANS THAT SOLAR ARRAYS ARE PADDLES AND MOUNTED AT
C CENTER OF VEHICLE. ICHECK= 1 MEANS OTHERWISE.
A2
XL= EQBLG
IF(ICHECK.EQ.2)
F
T
XL= .5*EQBLG
IF(NCONF(5).NE.1.AND.NCONF(5).NE.3.AND.NCONF(5).NE.5)
F
T
GO TO 2
3
A3
C SOLAR ARRAYS ARE PADDLES
C APPLIED LOAD (ONLY BENDING MOMENT)
C COMPUTE WEIGHT PER PADDLE (ASSUME 2 PADDLES)
WE= .5*SOARWT
XMA= 1.25*SABOLG*WE*SQRT(CA*CA + CE*CE)
C NOMINAL TUBE RADIUS
R= (SABOLG**4*XMA/(PI**5*E))**.1428
C TUBE WALL THICKNESS
TW= 2.*SQRT(XMA/(PI*E*R))

CONT. ON PG 3

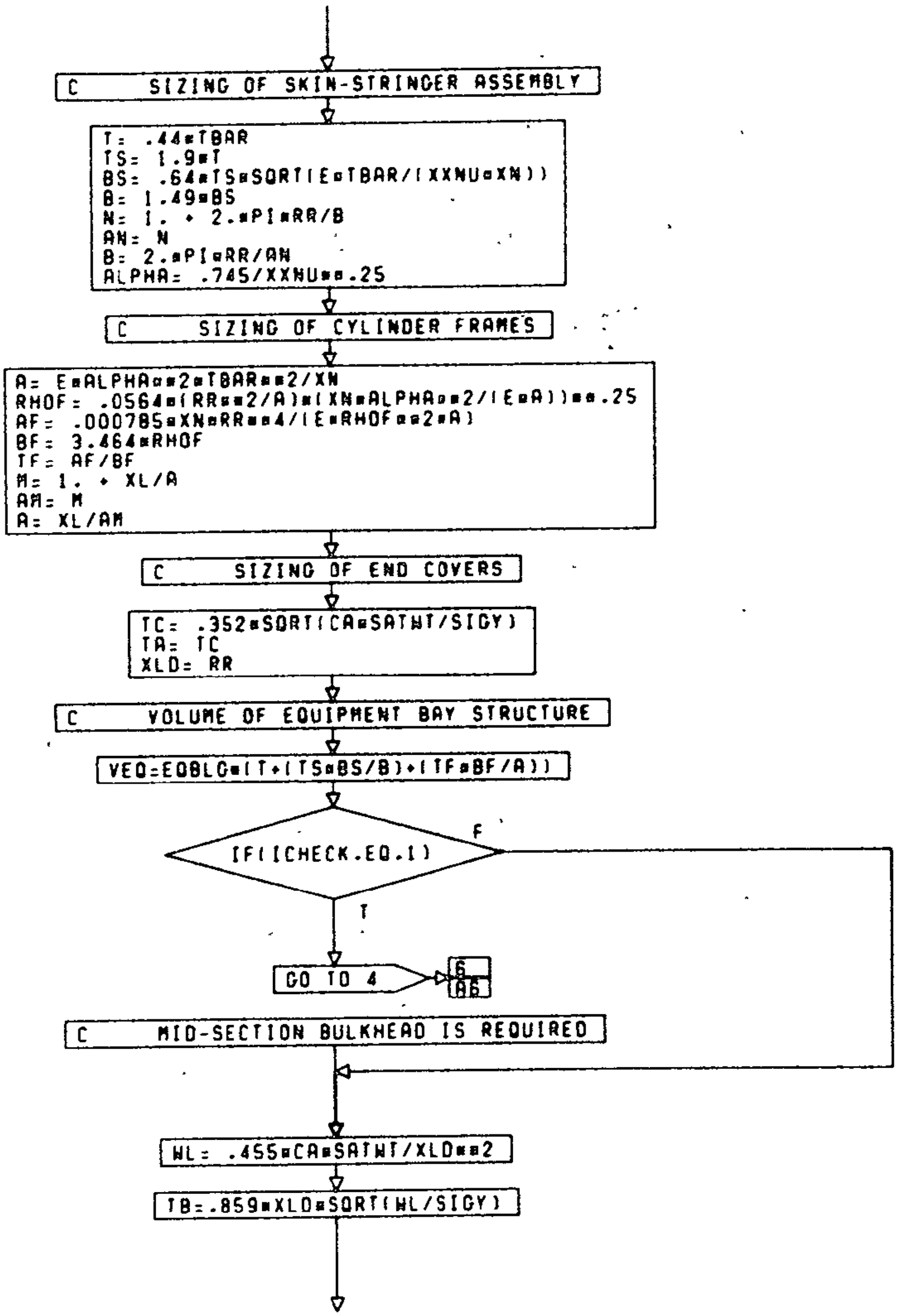


C CHECK FOR APPLICABILITY OF EULER COLUMN STABILITY
FAC1= (PI*E**2*XMA/(8.*R*SABOLG**2))**.3333
IF(SIGY-FAC1.GE.0.)
F
T
GO TO 1
C EULER COLUMN STABILITY NOT APPLICABLE
TW= (16.*SIGY*XMA/(PI*E**2))**.3333
R= TW*E/(4.*SIGY)
C VOLUME OF SOLAR BOOM
1
VARAY=R*TW*SABOLG
C SIZING OF EQUIPMENT BAY STRUCTURE
2
A3
2
CONTINUE
P= CA*SATWT
C BENDING MOMENT
XM= .75*CE*EQBLG*SATWT
IF(ICHECK.EQ.1)
F
4
A5
T
4
A4

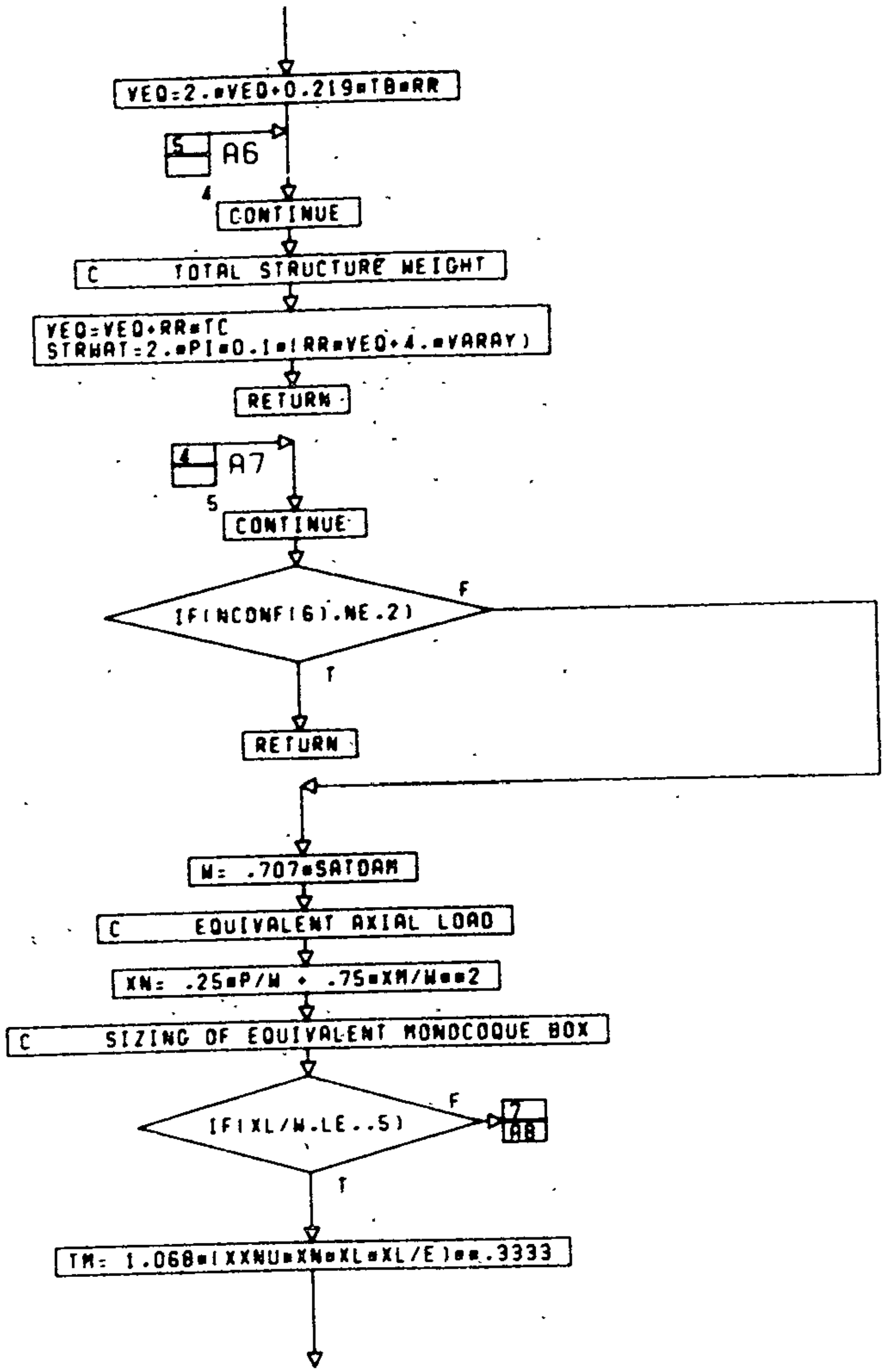
CONT. ON PG 4


A4
XA= CE*EQBLG*SATWT
A5
IF(NCONF(6).NE.1)
F
T
GO TO 5
A7
C EQUIVALENT AXIAL LOAD
RR= .5*SATDAM
XN= P/(2.*PI*RR) + XA/(PI*RR*RR)
C SIZING OF EQUIVALENT MONOCOQUE CYLINDER
TM= .672*(XXNU*XN*XL*XL/E)**.3333
FAC2= XL**2*SQRT(XXNU)/(RR*TM)
IF(FAC2.LE.31)
F
T
GO TO 3
TM= 2.76*SQRT(SQRT(XXNU)*XN*RR/E)
3
CONTINUE
C EQUIVALENT THICKNESS OF STIFFENED CYLINDER
TBAR= .267*TM

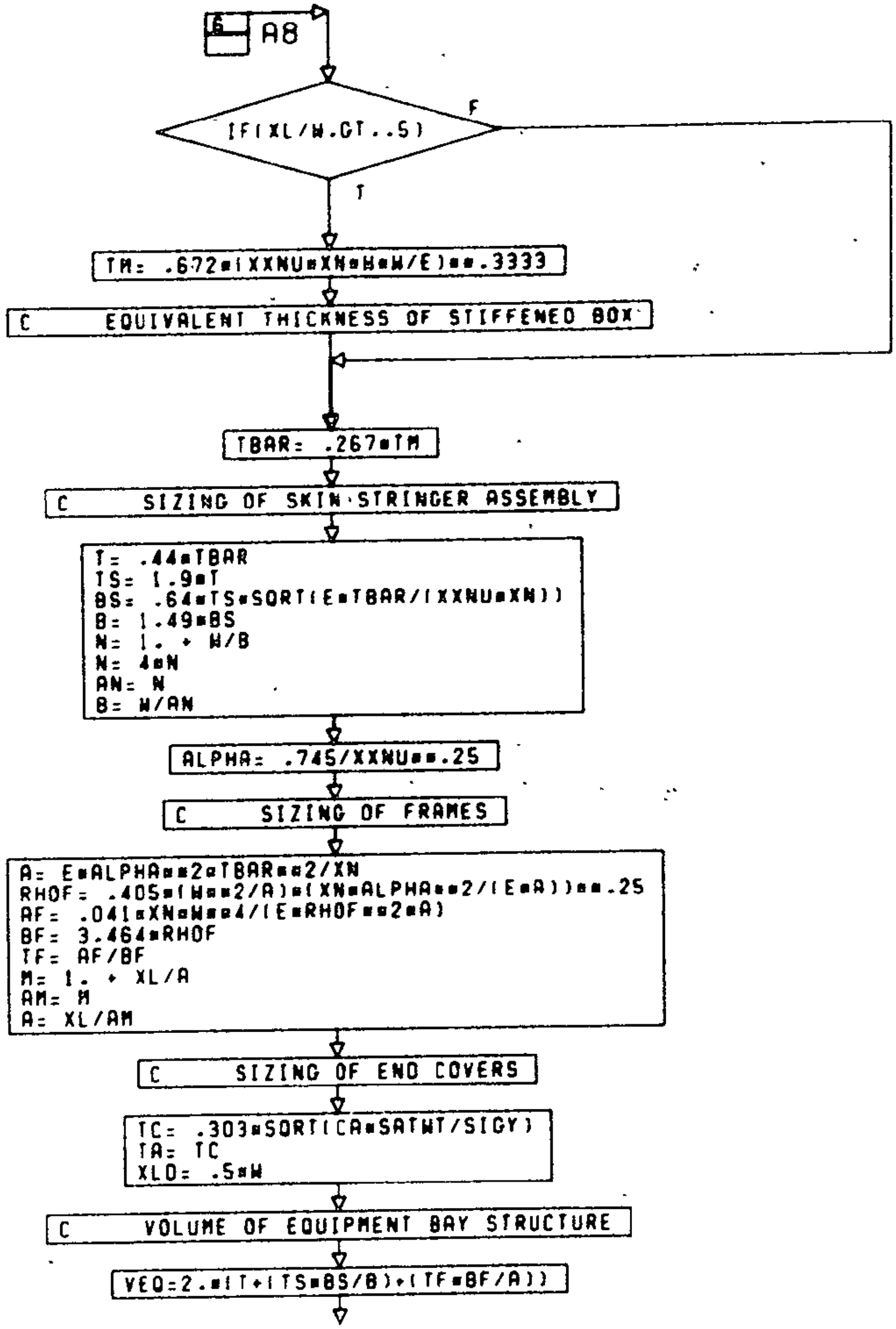
CONT. ON PG 5


C SIZING OF SKIN-STRINGER ASSEMBLY
T= .44*TBAR
TS= 1.9*T
BS= .64*TS*SQRT(E*TBAR/(XXNU*XN))
B= 1.49*BS
N= 1. + 2.*PI*RR/B
AN= N
B= 2.*PI*RR/AN
ALPHA= .745/XXNU**.25
C SIZING OF CYLINDER FRAMES
A= E*ALPHA**2*TBAR**2/XN
RHOF= .0564*(RR**2/A)*(XN*ALPHA**2/(E*A))**.25
AF= .000785*XN*RR**4/(E*RHOF**2*A)
BF= 3.464*RHOF
TF= AF/BF
M= 1. + XL/A
AM= M
A= XL/AM
C SIZING OF END COVERS
TC= .352*SQRT(CA*SATWT/SIGY)
TA= TC
XLD= RR
C VOLUME OF EQUIPMENT BAY STRUCTURE
VEQ=EQBLG*(T+(TS*BS/B)+(TF*BF/A))
IF(ICHECK.EQ.1)
F
T
GO TO 4
6
A6
C MID-SECTION BULKHEAD IS REQUIRED
WL= .455*CA*SATWT/XLD**2
TB=.859*XLD*SQRT(WL/SIGY)

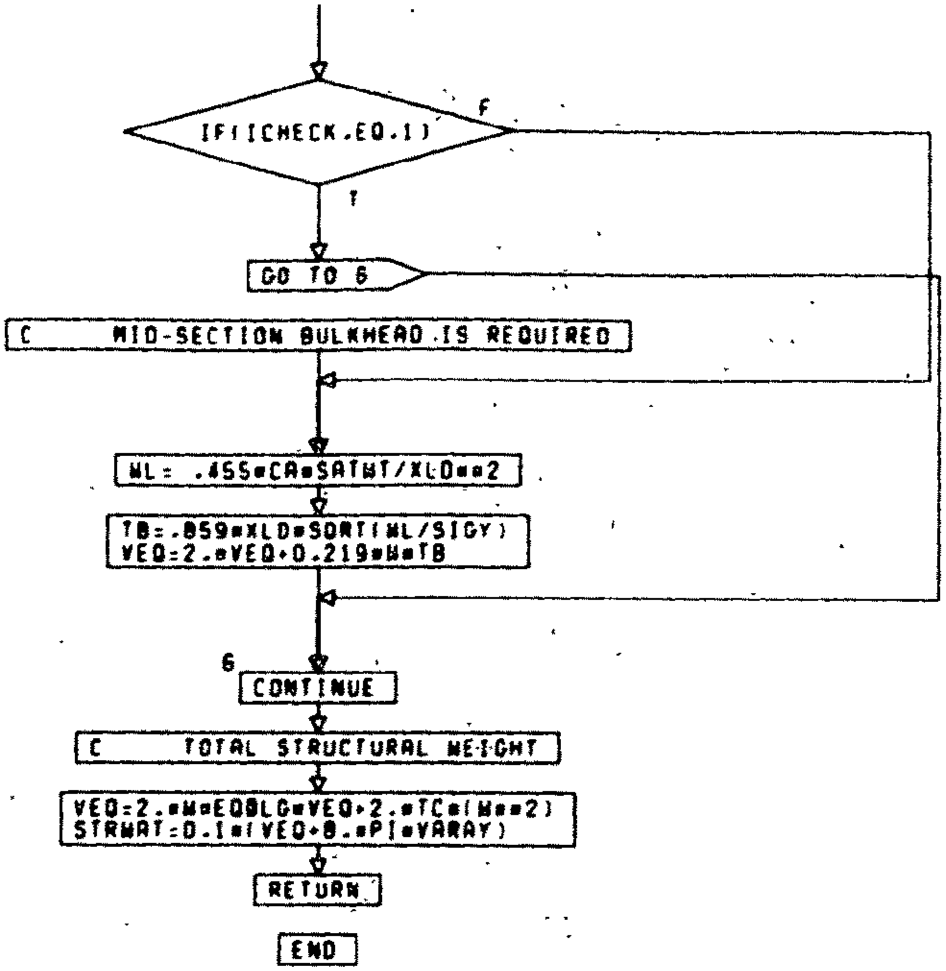
CONT. ON PG 6


VEQ=2.*VEQ+0.219*TB*RR
5
A6
4
CONTINUE
C TOTAL STRUCTURE WEIGHT
VEQ=VEQ+RR*TC
STRWAT=2.*PI*0.1*(RR*VEQ+4.*VARAY)
RETURN
4
A7
5
CONTINUE
IF(NCONF(6).NE.2)
F
T
RETURN
W= .707*SATDAM
C EQUIVALENT AXIAL LOAD
XN= .25*P/W + .75*XM/W**2
C SIZING OF EQUIVALENT MONOCOQUE BOX
IF(XL/W.LE..5)
F
7
A8
T
TM= 1.068*(XXNU*XN*XL*XL/E)**.3333

CONT. ON PG 7


A8
IF(XL/W.GT..5)
F
T
TM= .672*(XXNU*XN*W*W/E)**.3333
C EQUIVALENT THICKNESS OF STIFFENED BOX
TBAR= .267*TM
C SIZING OF SKIN STRINGER ASSEMBLY
T= .44*TBAR
TS= 1.9*T
BS= .64*TS*SQRT(E*TBAR/(XXNU*XN))
B= 1.49*BS
N= 1. + W/B
N= 4*N
AN= N
B= W/AN
ALPHA= .745/XXNU**.25
C SIZING OF FRAMES
A= E*ALPHA**2*TBAR**2/XN
RHOF= .405*(W**2/A)*(XN*ALPHA**2/(E*A))**.25
AF= .041*XN*W**4/(E*RHOF**2*A)
BF= 3.464*RHOF
TF= AF/BF
M= 1. + XL/A
AM= M
A= XL/AM
C SIZING OF END COVERS
TC= .303*SQRT(CA*SATWT/SIGY)
TA= TC
XLO= .5*W
C VOLUME OF EQUIPMENT BAY STRUCTURE
VEQ=2.*(T+(TS*BS/B)+(TF*BF/A))

CONT. ON PG 8


IF(ICHECK.EQ.1)
F
T
GO TO 6
C MID-SECTION BULKHEAD IS REQUIRED
WL= .455*CA*SATWT/XLD**2
TB=.859*XLD*SQRT(WL/SIGY)
VEQ=2.*VEQ+0.219*W*TB
6
CONTINUE
C TOTAL STRUCTURAL WEIGHT
VEQ=2.*W*EQBLG*VEQ+2.*TC*(W**2)
STRWAT=0.1*(VEQ+8.*PI*VARAY)
RETURN
END

PG 8 FINAL

```
SUBROUTINE VESIZE(IERR,NCONF,ICHOSE)
```

```
DIMENSION NCONF(6),EESID(9),EEYCG(9),EEZCG(9),EEINX(9),EEINY(9),
 EEINZ(9),EEXCG(9)
```

```
COMMON /USER6/ CGEEX(9), EELOC(9), EEQVL(9),   EM1YCG,    EM1ZCG,
         EQPF,   EM2YCG,   EM2ZCG,   ISBOFG,   NUMEEQ,    XCGSA3
```

```
COMMON /USERI/     APOGEE,    COMRAT,    DIAMAX, EEQWT(9),      EPME,
                   EQM1WT,    EQM1XL,    EQM1YL,   EQM1ZL,    EQM2WT,
                   EQM2XL,    EQM2YL,    EQM2ZL,       FE,    IAGNCY,
        IDEBUG,    ISATOR,    MB12SM,    OPTEMP,   ORBINC,    PERIGE,
         MICRO,     RELME,   SPEC(6),     SPECI,        T,    XCGSA1,
                     XMER,      XMEU
```

```
COMMON /BTWN/       ACSSW,     ACSWP,       ALT,   SOAREA,    BATCAP,
               BITRAT(2),     CLIFE,    CONVWT,   SATOAM,        DT,
                       DX,        DY,        DZ,   EQBLG,     EQBSIO,
                       FC,        FF,    HARNWT,      HPT,    HTPIPE,
                     HTPT,    HTRPRB,    HTRPWR,              IBTLOC,
                    LMBDO,        NC,     OMEGS,   PASSTR,        PJ,
                       PL,     PLMIN,    POCNWT,     RADA,     RADAB,
                      RAT,        RJ,    SABOLG,    SATLG,    SATTWT,
```

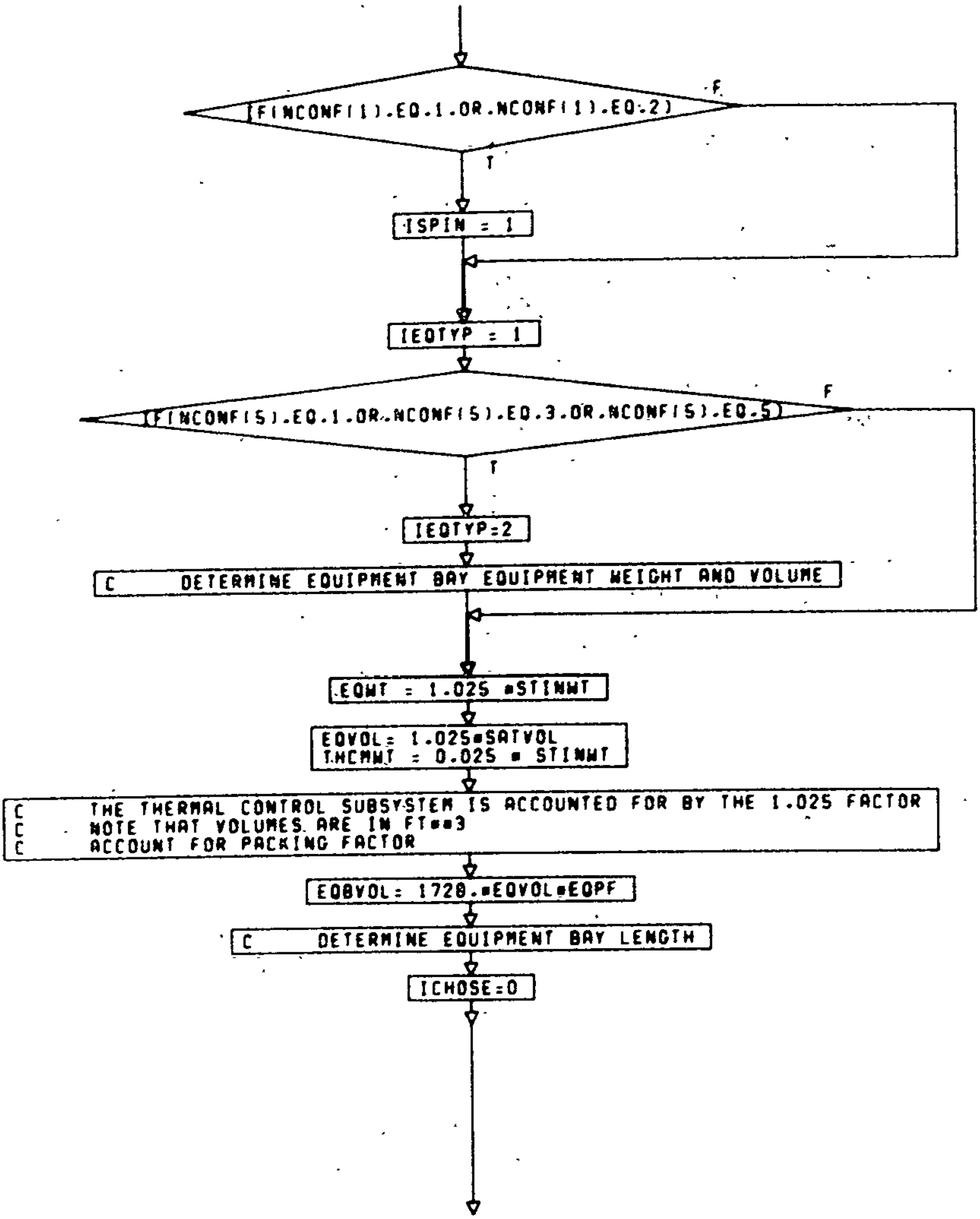
```
                    SATWT,    SATXCG,    SATYCG,   SATZCG,     SAIXL,
                    SAIYL,     SAIZL,      SIDE,    SYSLB,    THCMWT,
               THRUST(2),        TI,     TNKWT,    TPRIM,        VB,
                     VCHP,    SATVOL,    SOARWT,       WB,       WBT,
                   STINWT,    SATINX,    XNZERO,   SATINY,    SATINZ
```

```
COMMON/PRTCOM/   ACCRCY,        AM,        AN,       BF,        BS,
              COPI(7,2),    CISTAR,      CTOT,     DOTE,        DE,
                  DRIWT,    EQBSTR,    FEEINV,   FEEOPS,      FEER,
                    GSE,      IREL,    ITRUNC,   MMDOLD,NAME(3,60),
                    OPS,    PAYINV,    PAYOUL,     PAYR,        PE,
                    PMP,       PMR,  POWER(6),       PU,   PWR(60),
                    QCP,       QCR,  ROLD(60),   SABMWT,    SATADP,
                 SATINV,      SATR,      SEIP,     SEIR, SKTAU(6),
```

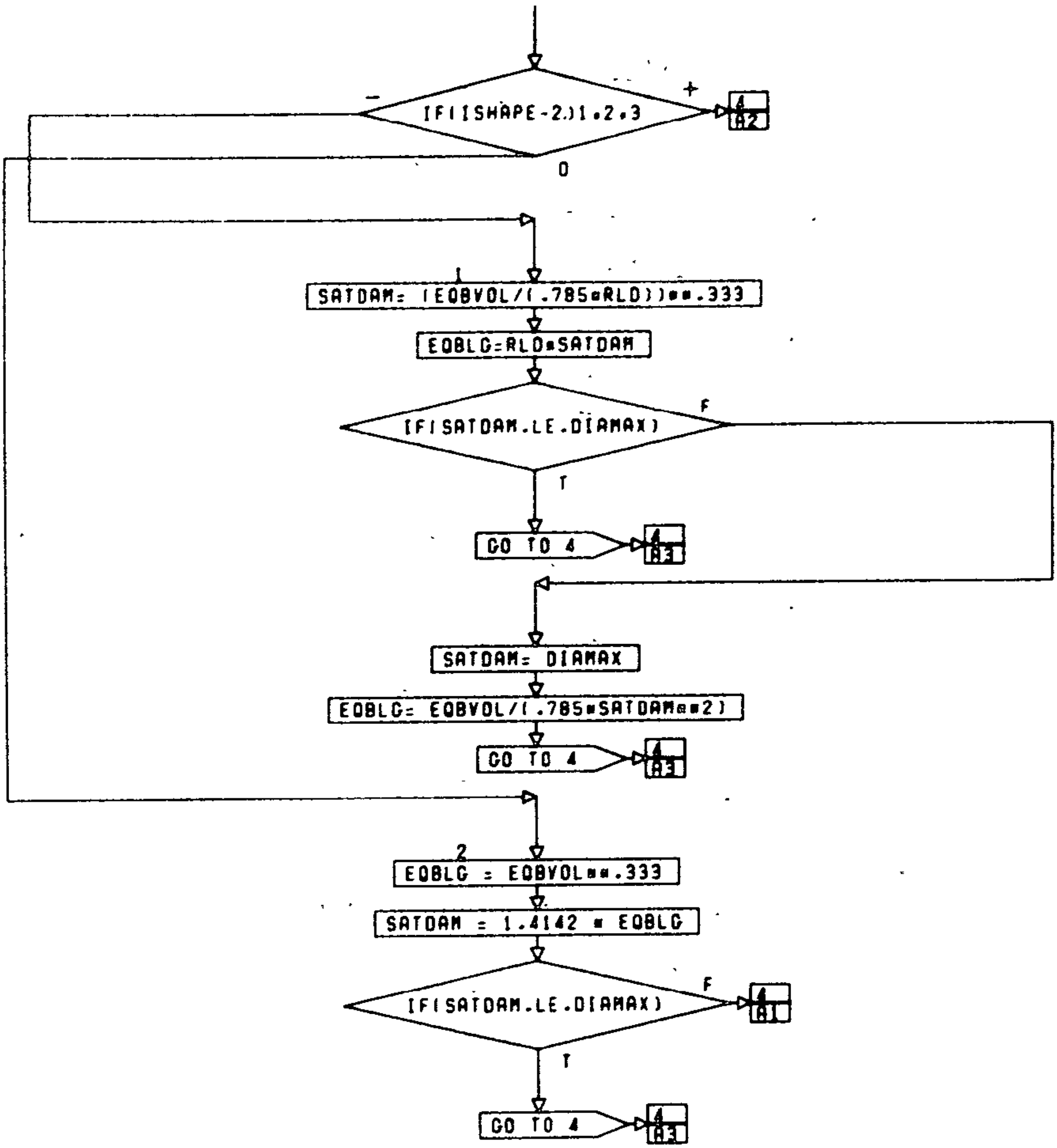
```
             SSREL(6),   SUBE(7),   SUBT(7), SUBUE(7),  SUBUP(7),
                   TA, TAU(6,6),         TB,       TC,        TE,
                   TF,     TOOLR,     TOOLU,   TOTOPS,     TRUNC,
                   TS,     TTT,VOLUME(6),    VOL(60),WEIGHT(6),
                XLTOT,      XMEH,    XMEINV,     XMEL,     XMEVL,
                 XMEW,     XMEWT,     XVEST
```

```
ISHAPE = NCONF(6)
ISPIN = 0
RLD  =  0.600
XMEL=EQM1XL+EQM2XL
XMEW = AMAX1(EQM1YL,EQM2YL)
XMEH = AMAX1(EQM1ZL,EQM2ZL)
EQM1ST = 0.0
EQM2ST = 0.0
```

CONT. ON PG 2

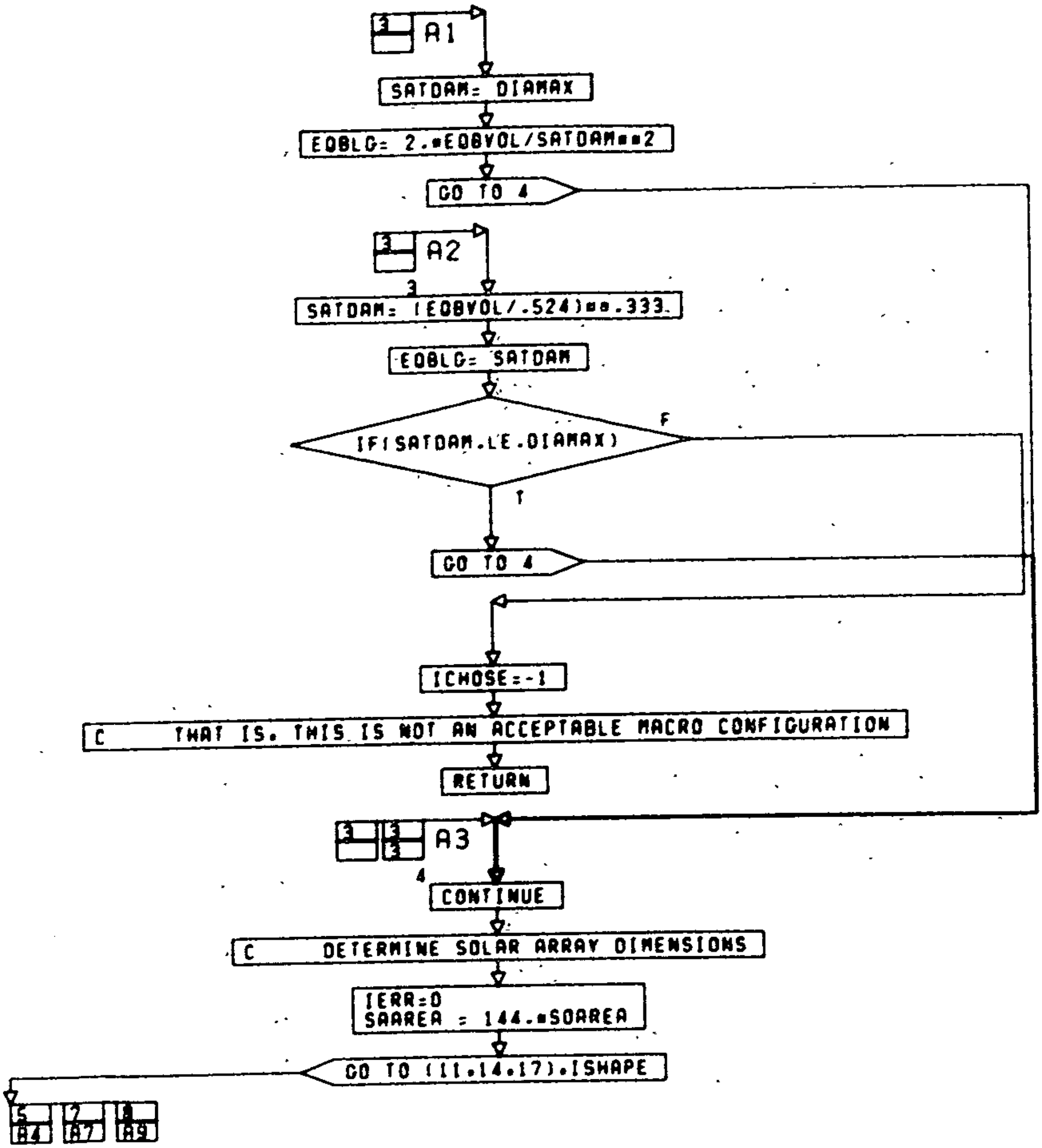

IF(NCONF(1).EQ.1.OR.NCONF(1).EQ.2)
F
T
ISPIN = 1
IEQTYP = 1
IF(NCONF(5).EQ.1.OR.NCONF(5).EQ.3.OR.NCONF(5).EQ.5)
F
T
IEQTYP=2
C DETERMINE EQUIPMENT BAY EQUIPMENT WEIGHT AND VOLUME
EQWT = 1.025 *STINWT
EQVOL= 1.025*SATVOL
THCMWT = 0.025 * STINWT
C THE THERMAL CONTROL SUBSYSTEM IS ACCOUNTED FOR BY THE 1.025 FACTOR
C NOTE THAT VOLUMES ARE IN FT**3
C ACCOUNT FOR PACKING FACTOR
EQBVOL= 1728.*EQVOL*EQPF
C DETERMINE EQUIPMENT BAY LENGTH
ICHOSE=0

CONT. ON PG 3

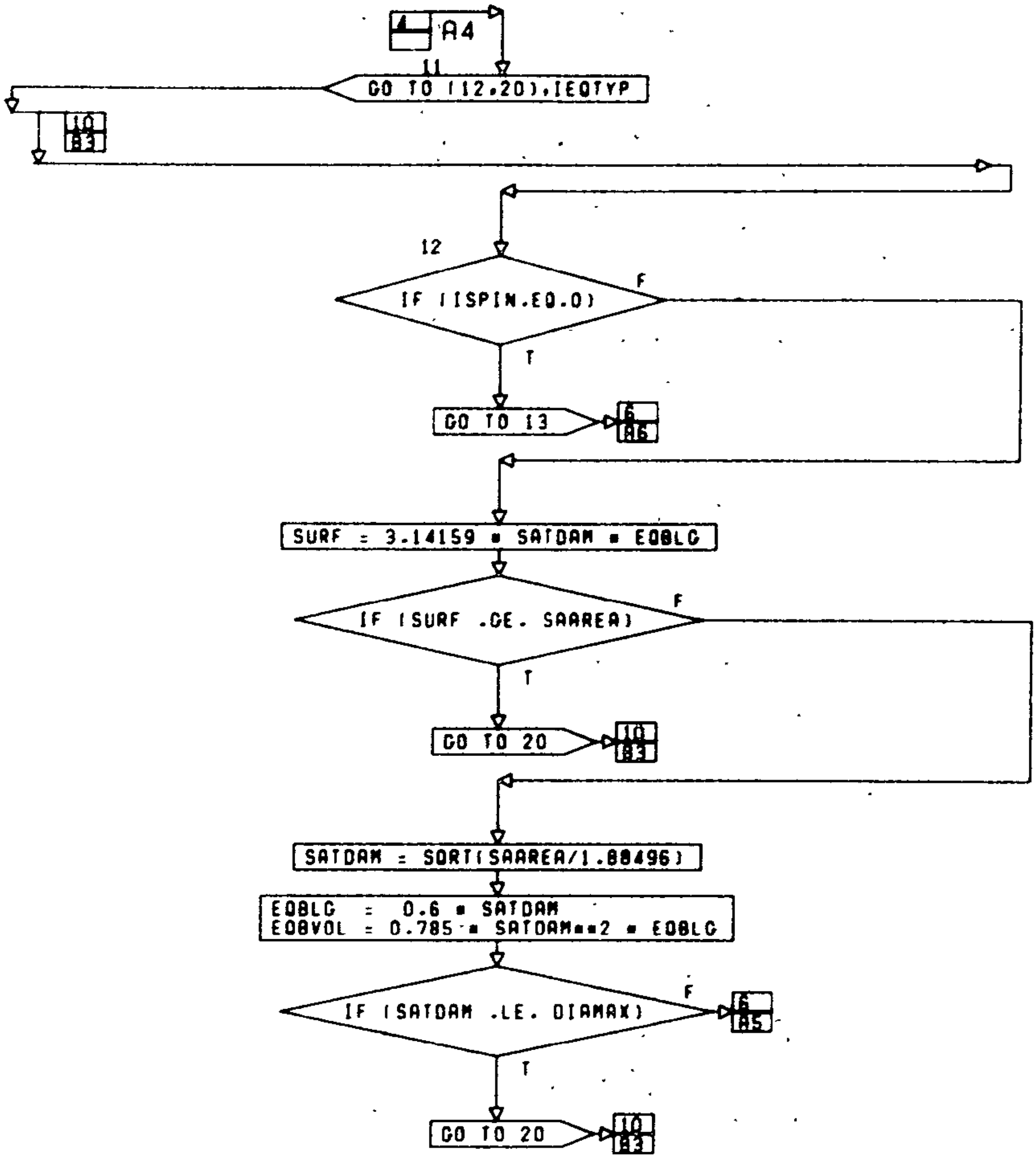


IF(ISHAPE-2.)1,2,3
-
+
0
4
A2
1
SATDAM= (EQBVOL/(.785*RLD))**.333
EQBLG=RLD*SATDAM
IF(SATDAM.LE.DIAMAX)
F
T
GO TO 4
4
A3
SATDAM= DIAMAX
EQBLG= EQBVOL/(.785*SATDAM**2)
GO TO 4
4
A3
2
EQBLG = EQBVOL**.333
SATDAM = 1.4142 * EQBLG
IF(SATDAM.LE.DIAMAX)
F
4
A1
T
GO TO 4
4
A3

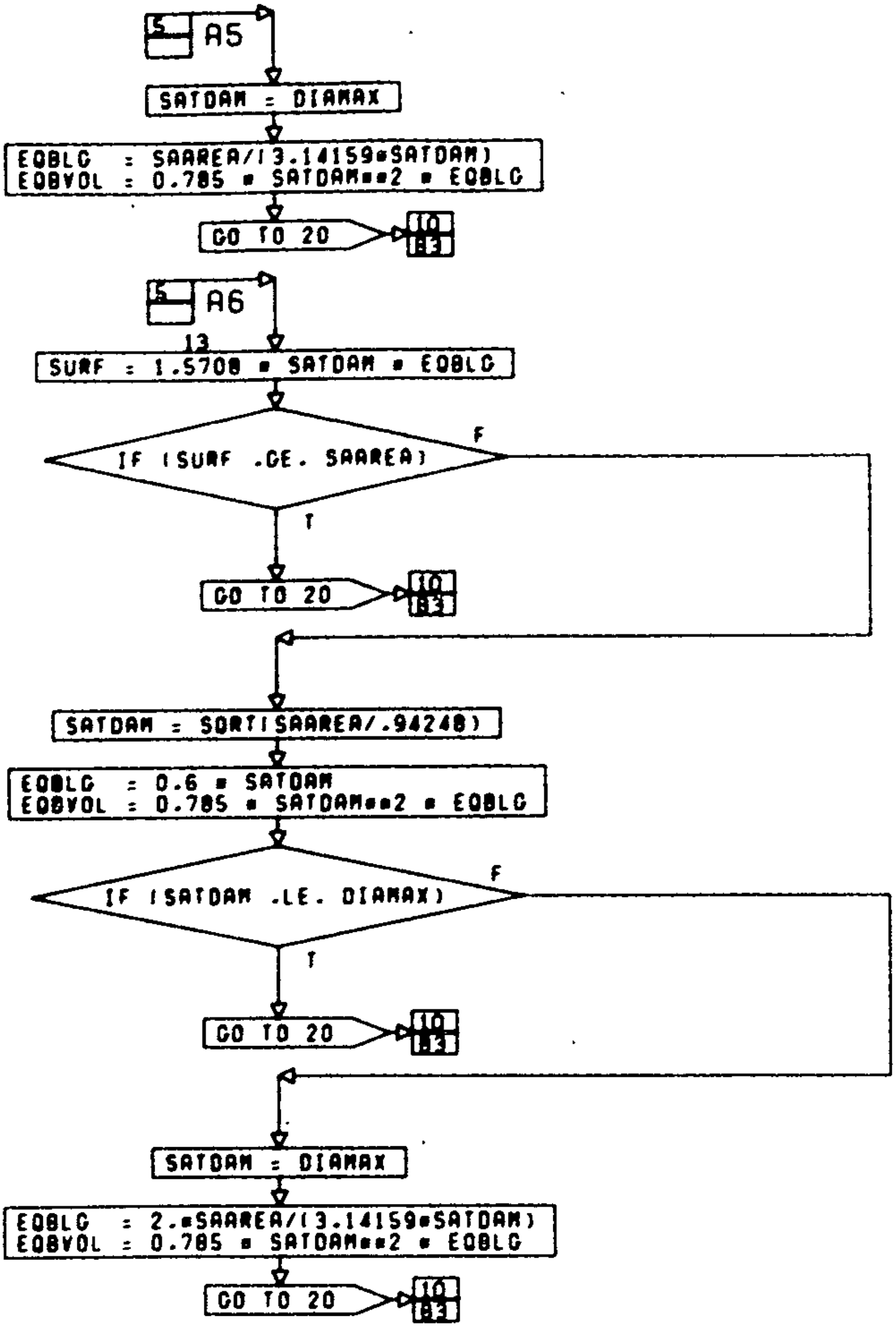
CONT. ON PG 4


A1
SATDAM= DIAMAX
EQBLG= 2.*EQBVOL/SATDAM**2
GO TO 4
A2
3
SATDAM= (EQBVOL/.524)**.333
EQBLG= SATDAM
IF(SATDAM.LE.DIAMAX)
F
T
GO TO 4
ICHOSE=-1
C THAT IS, THIS IS NOT AN ACCEPTABLE MACRO CONFIGURATION
RETURN
A3
4
CONTINUE
C DETERMINE SOLAR ARRAY DIMENSIONS
IERR=0
SAAREA = 144.*SOAREA
GO TO (11,14,17),ISHAPE
A4
A7
A9

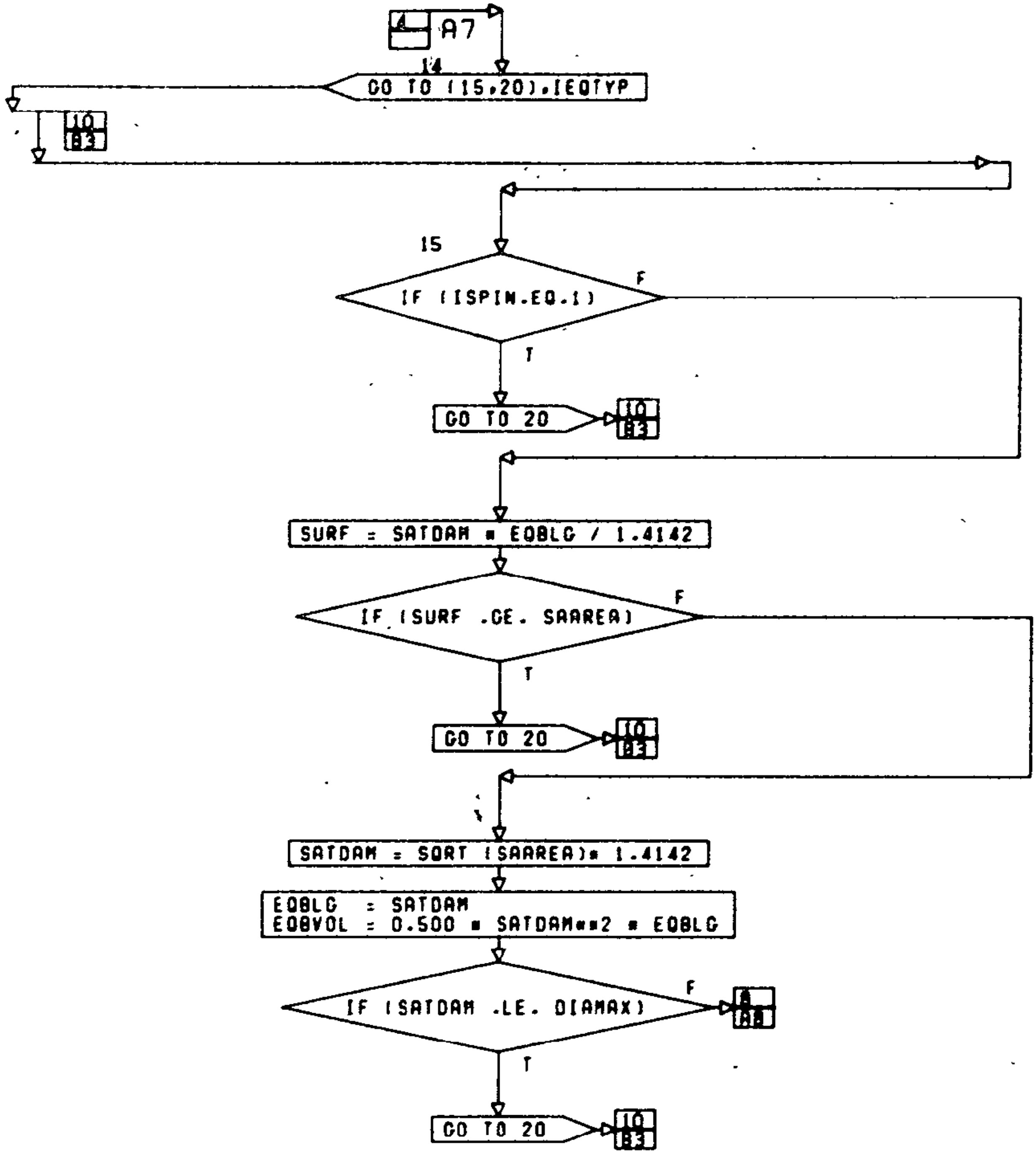
CONT. ON PG 5


4
A4
11
GO TO (12,20),IEQTYP
10
B3
12
IF (ISPIN.EQ.0)
F
T
GO TO 13
6
A6
SURF = 3.14159 * SATDAM * EQBLG
IF (SURF .GE. SAAREA)
F
T
GO TO 20
10
B3
SATDAM = SQRT(SAAREA/1.88496)
EQBLG = 0.6 * SATDAM
EQBVOL = 0.785 * SATDAM**2 * EQBLG
IF (SATDAM .LE. DIAMAX)
F
6
A5
T
GO TO 20
10
B3

CONT. ON PG 6

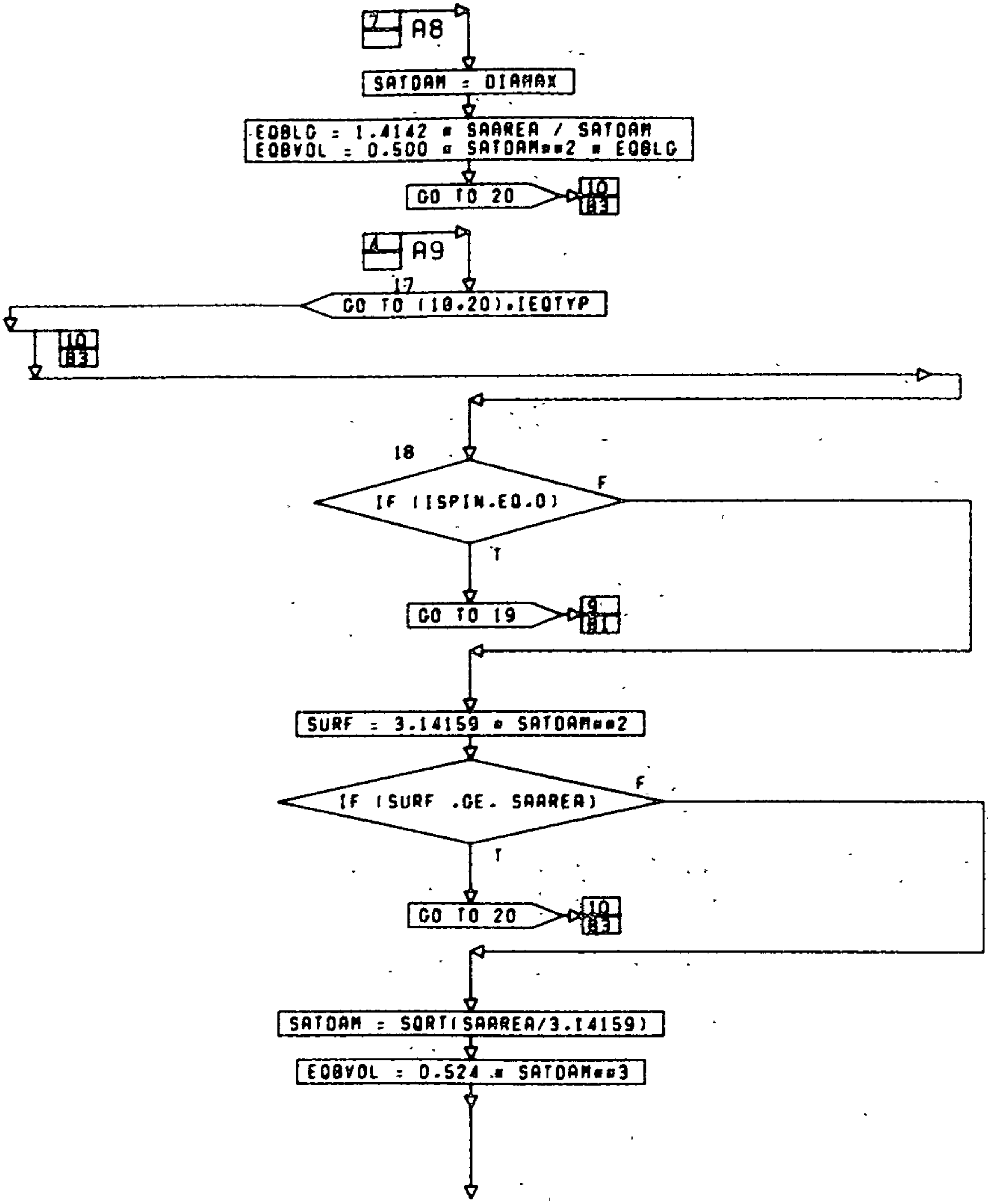

5
A5
SATDAM = DIAMAX
EQBLG = SAAREA/(3.14159*SATDAM)
EQBVOL = 0.785 * SATDAM**2 * EQBLG
GO TO 20
10
B3
5
A6
13
SURF = 1.5708 * SATDAM * EQBLG
IF (SURF .GE. SAAREA)
F
T
GO TO 20
10
B3
SATDAM = SQRT(SAAREA/.94248)
EQBLG = 0.6 * SATDAM
EQBVOL = 0.785 * SATDAM**2 * EQBLG
IF (SATDAM .LE. DIAMAX)
F
T
GO TO 20
10
B3
SATDAM = DIAMAX
EQBLG = 2.*SAAREA/(3.14159*SATDAM)
EQBVOL = 0.785 * SATDAM**2 * EQBLG
GO TO 20
10
B3

CONT. ON PG 7

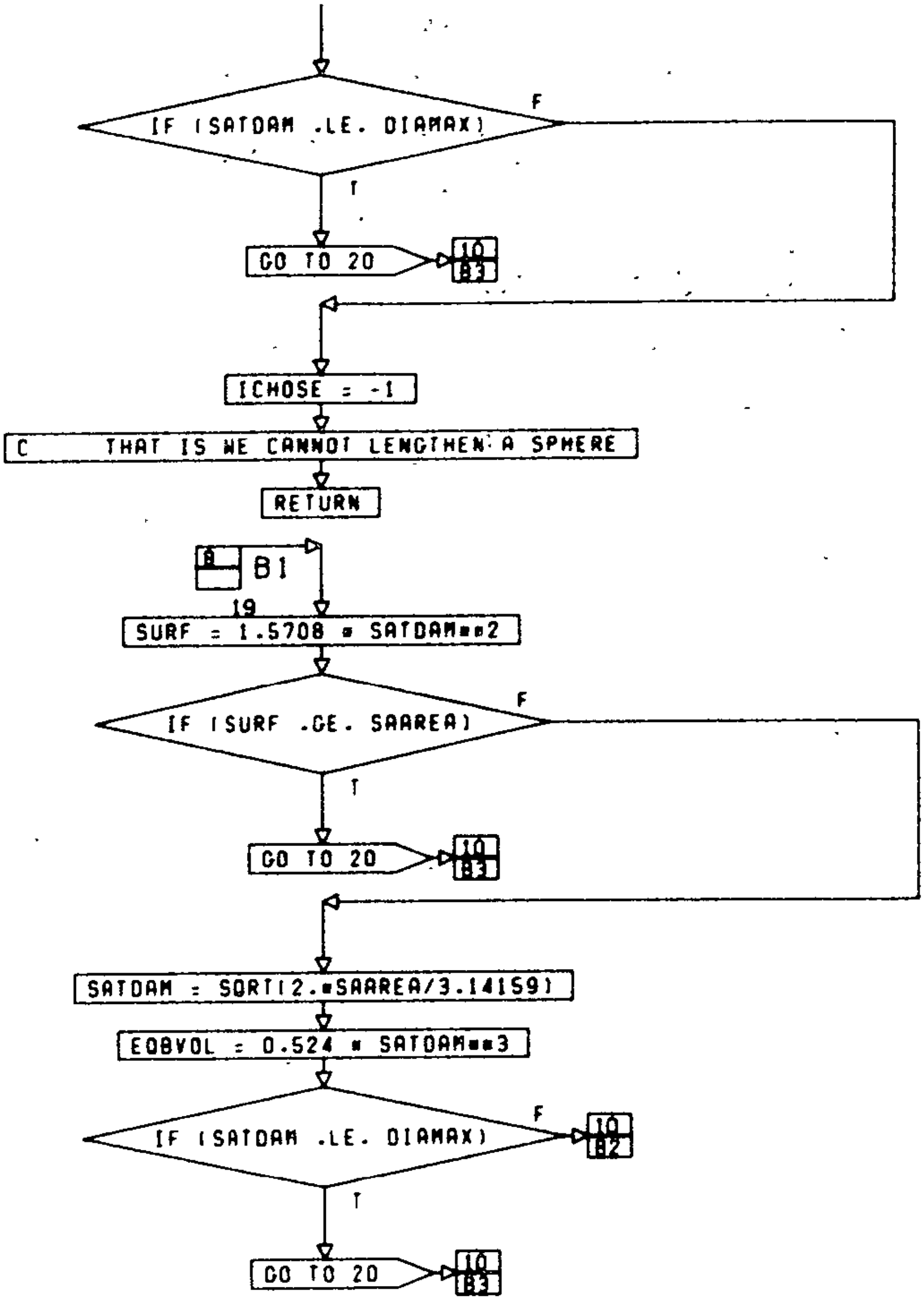


4
A7
14
GO TO (15,20),IEQTYP
10
B3
15
IF (ISPIN.EQ.1)
F
T
GO TO 20
10
B3
SURF = SATDAM * EQBLG / 1.4142
IF (SURF .GE. SAAREA)
F
T
GO TO 20
10
B3
SATDAM = SQRT (SAAREA)* 1.4142
EQBLG = SATDAM
EQBVOL = 0.500 * SATDAM**2 * EQBLG
IF (SATDAM .LE. DIAMAX)
F
8
A8
T
GO TO 20
10
B3

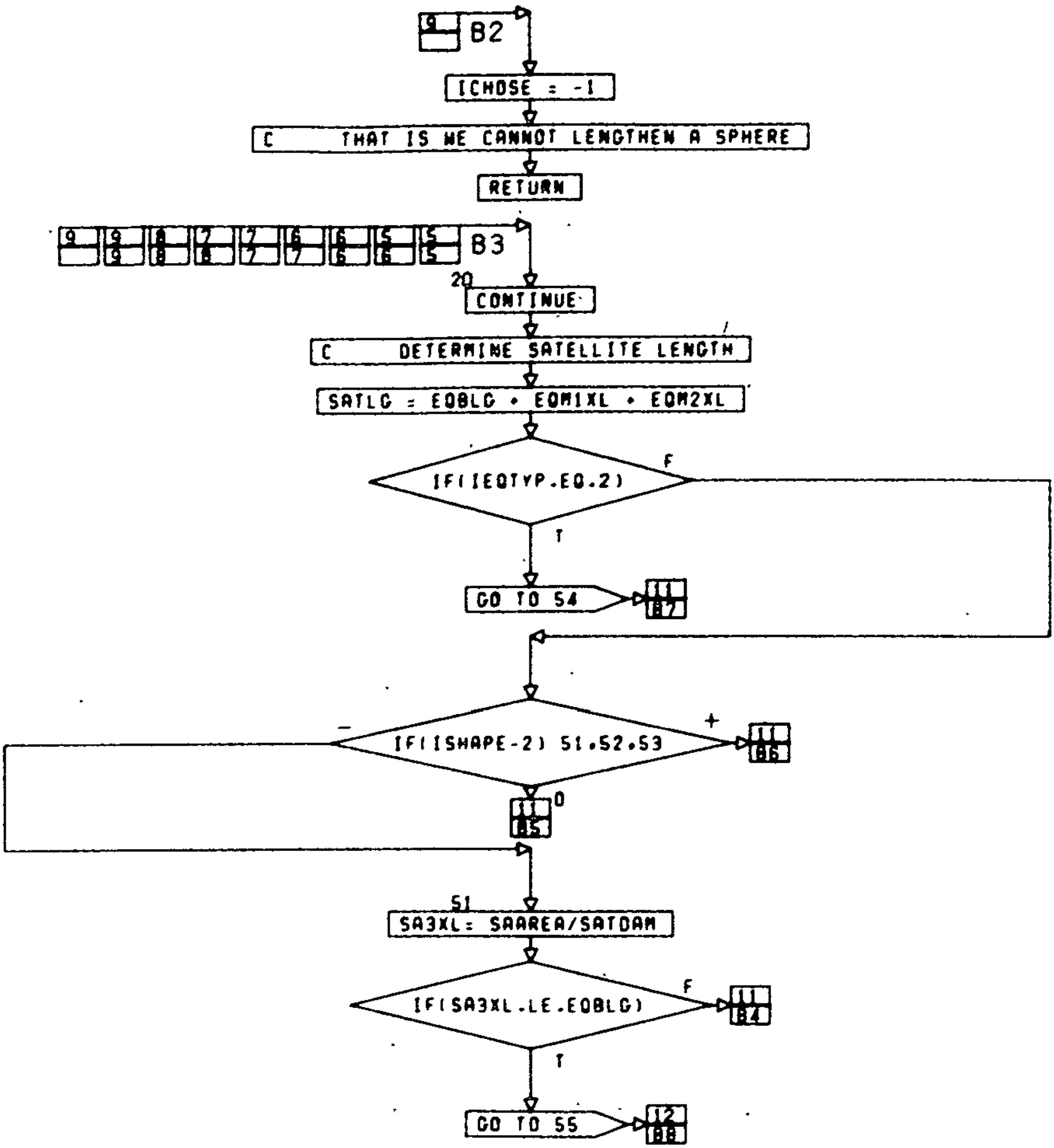
CONT. ON PG 8


7
A8
SATDAM = DIAMAX
EQBLG = 1.4142 * SAAREA / SATDAM
EQBVOL = 0.500 * SATDAM**2 * EQBLG
GO TO 20
10
B3
6
A9
17
GO TO (18,20),IEQTYP
10
B3
18
IF (ISPIN.EQ.0)
F
T
GO TO 19
9
B1
SURF = 3.14159 * SATDAM**2
IF (SURF .GE. SAAREA)
F
T
GO TO 20
10
B3
SATDAM = SQRT(SAAREA/3.14159)
EQBVOL = 0.524 * SATDAM**3

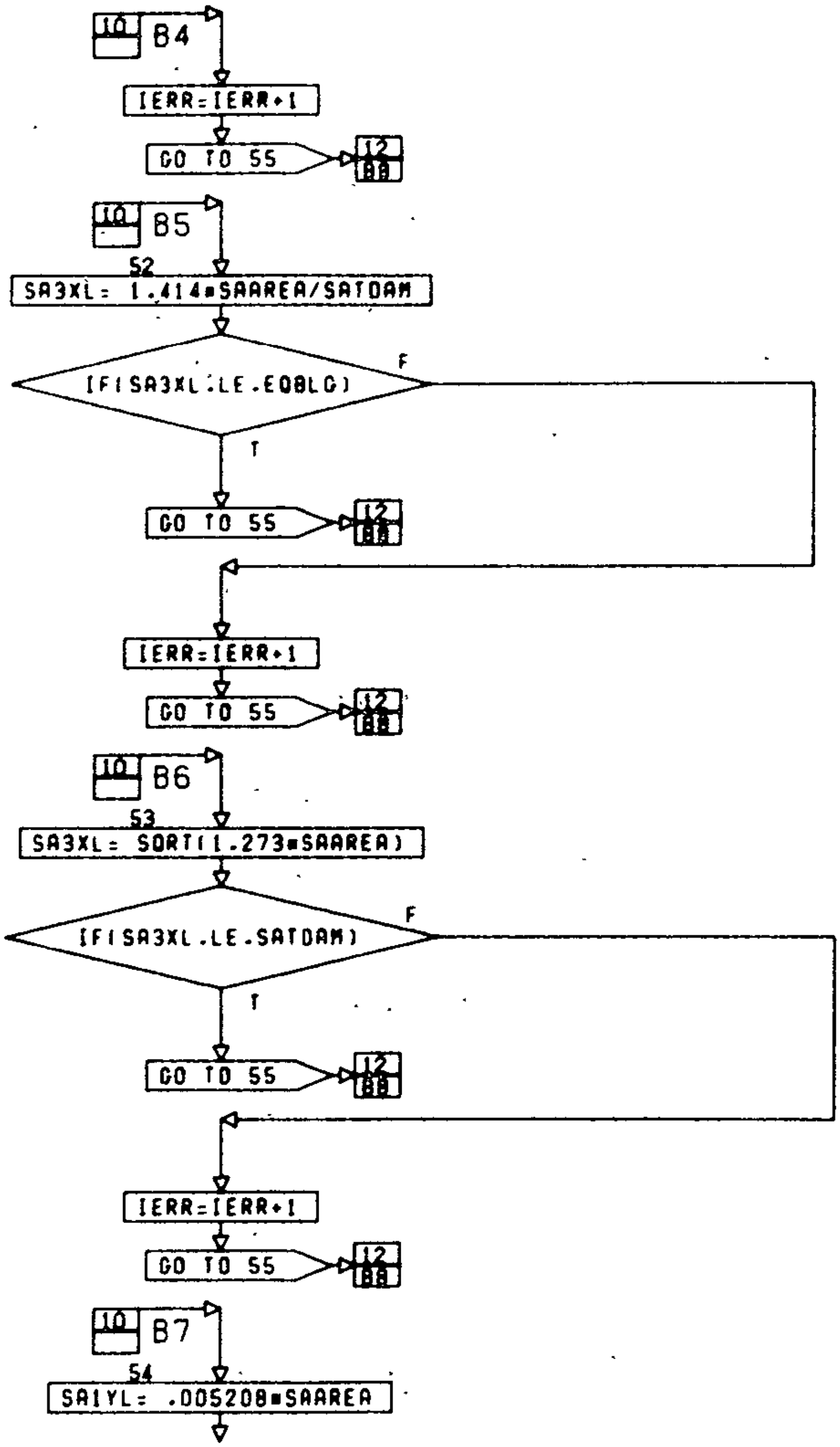
CONT. ON PG 9


IF (SATDAM .LE. DIAMAX)
F
T
GO TO 20
10
B3
ICHOSE = -1
C THAT IS WE CANNOT LENGTHEN A SPHERE
RETURN
A
B1
19
SURF = 1.5708 * SATDAM**2
IF (SURF .GE. SAAREA)
F
T
GO TO 20
10
B3
SATDAM = SQRT(2.*SAAREA/3.14159)
EQBVOL = 0.524 * SATDAM**3
IF (SATDAM .LE. DIAMAX)
F
10
B2
T
GO TO 20
10
B3

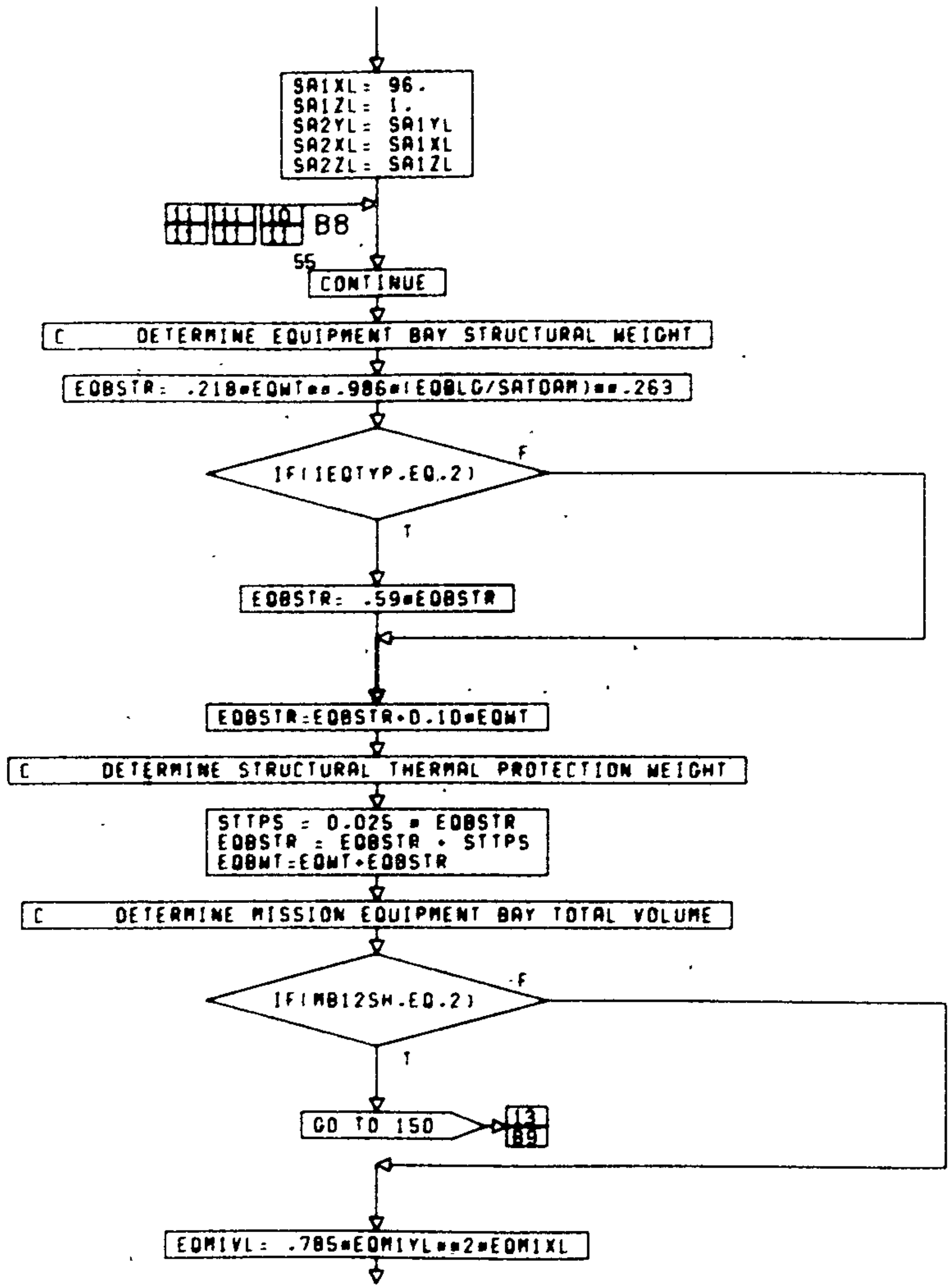
CONT. ON PG 10


B2
ICHOSE = -1
C THAT IS WE CANNOT LENGTHEN A SPHERE
RETURN
B3
20
CONTINUE
C DETERMINE SATELLITE LENGTH
SATLG = EQBLG + EQM1XL + EQM2XL
IF(IEQTYP.EQ.2)
F
T
GO TO 54
11
B7
IF(ISHAPE-2) 51,52,53
-
+
0
11
B6
11
B5
51
SA3XL= SAAREA/SATDAM
IF(SA3XL.LE.EQBLG)
F
T
11
B4
GO TO 55
12
B8

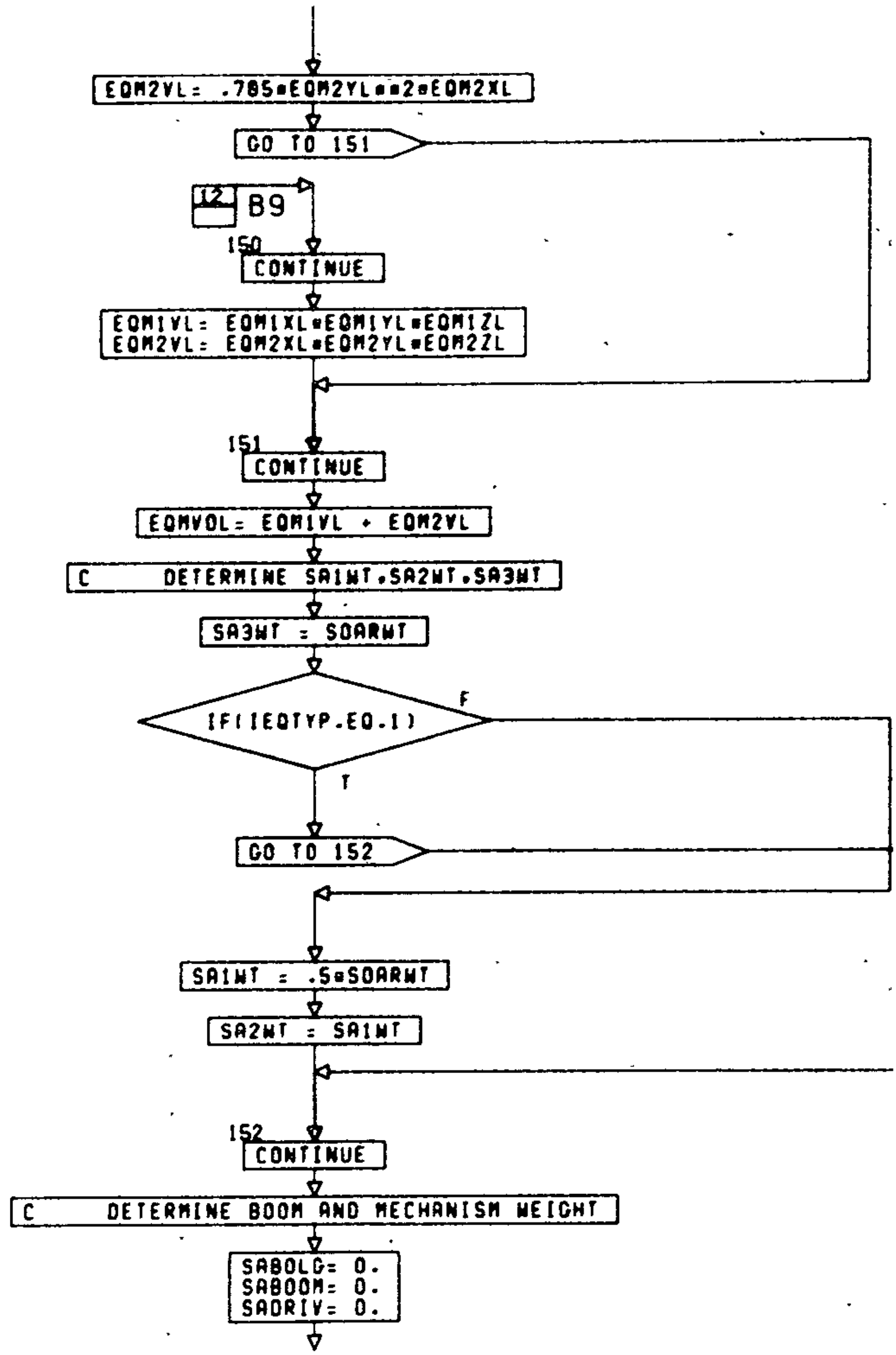
CONT. ON PG 11


10
B4
IERR=IERR+1
GO TO 55
12
BB
10
B5
52
SA3XL= 1.414*SAAREA/SATDAM
IF(SA3XL.LE.EQBLG)
F
T
GO TO 55
12
BB
IERR=IERR+1
GO TO 55
12
BB
10
B6
53
SA3XL= SQRT(1.273*SAAREA)
IF(SA3XL.LE.SATDAM)
F
T
GO TO 55
12
BB
IERR=IERR+1
GO TO 55
12
BB
10
B7
54
SA1YL= .005208*SAAREA

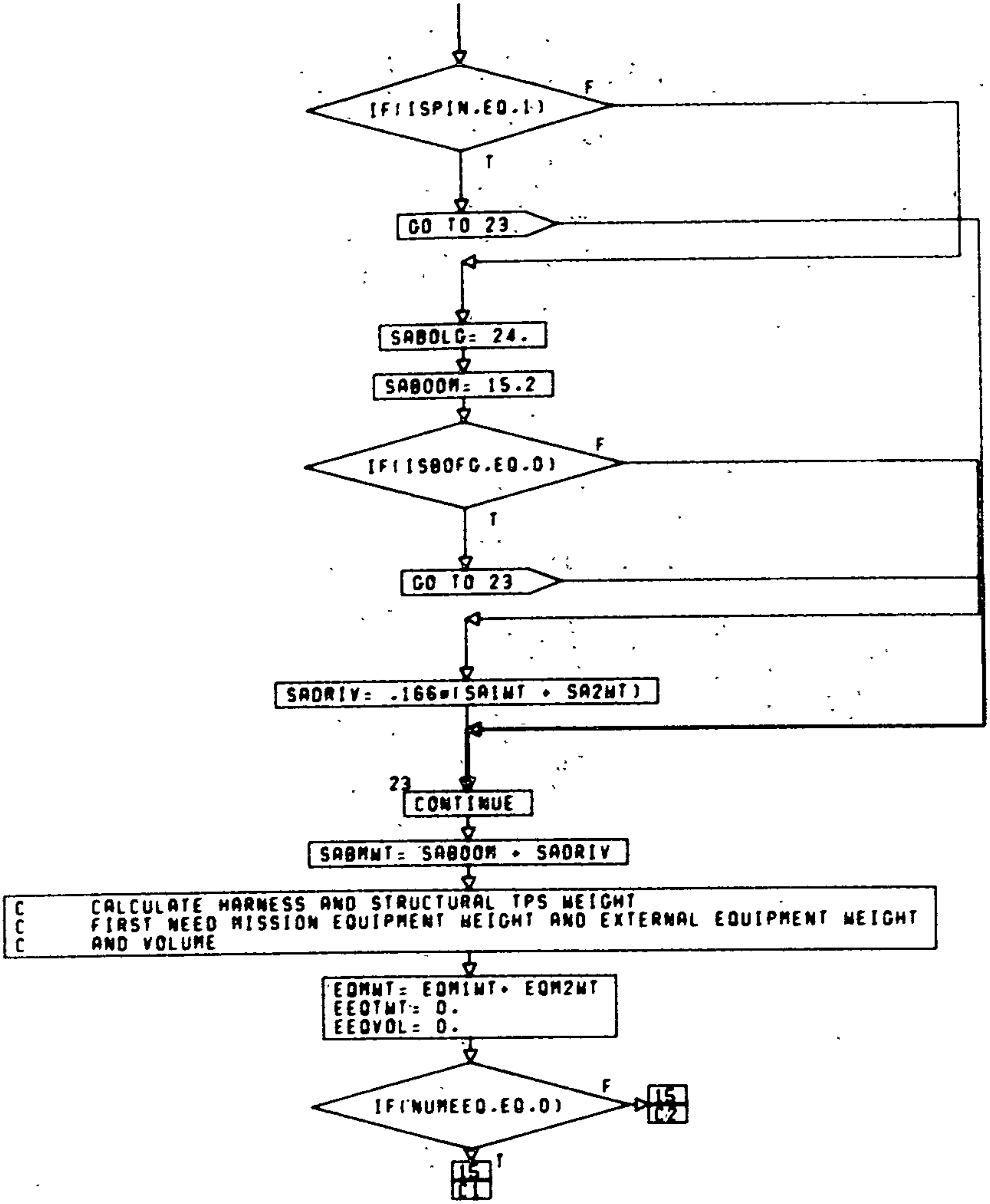
CONT. ON PG 12


SA1XL= 96.
SA1ZL= 1.
SA2YL= SA1YL
SA2XL= SA1XL
SA2ZL= SA1ZL
B8
55
CONTINUE
C DETERMINE EQUIPMENT BAY STRUCTURAL WEIGHT
EQBSTR= .218*EQWT**.986*(EQBLG/SATDAM)**.263
IF(IEQTYP.EQ.2)
F
T
EQBSTR= .59*EQBSTR
EQBSTR=EQBSTR+0.10*EQWT
C DETERMINE STRUCTURAL THERMAL PROTECTION WEIGHT
STTPS = 0.025 * EQBSTR
EQBSTR = EQBSTR + STTPS
EQBWT=EQWT+EQBSTR
C DETERMINE MISSION EQUIPMENT BAY TOTAL VOLUME
IF(MB12SH.EQ.2)
F
T
GO TO 150
13
B9
EQM1VL= .785*EQM1YL**2*EQM1XL

CONT. ON PG 13

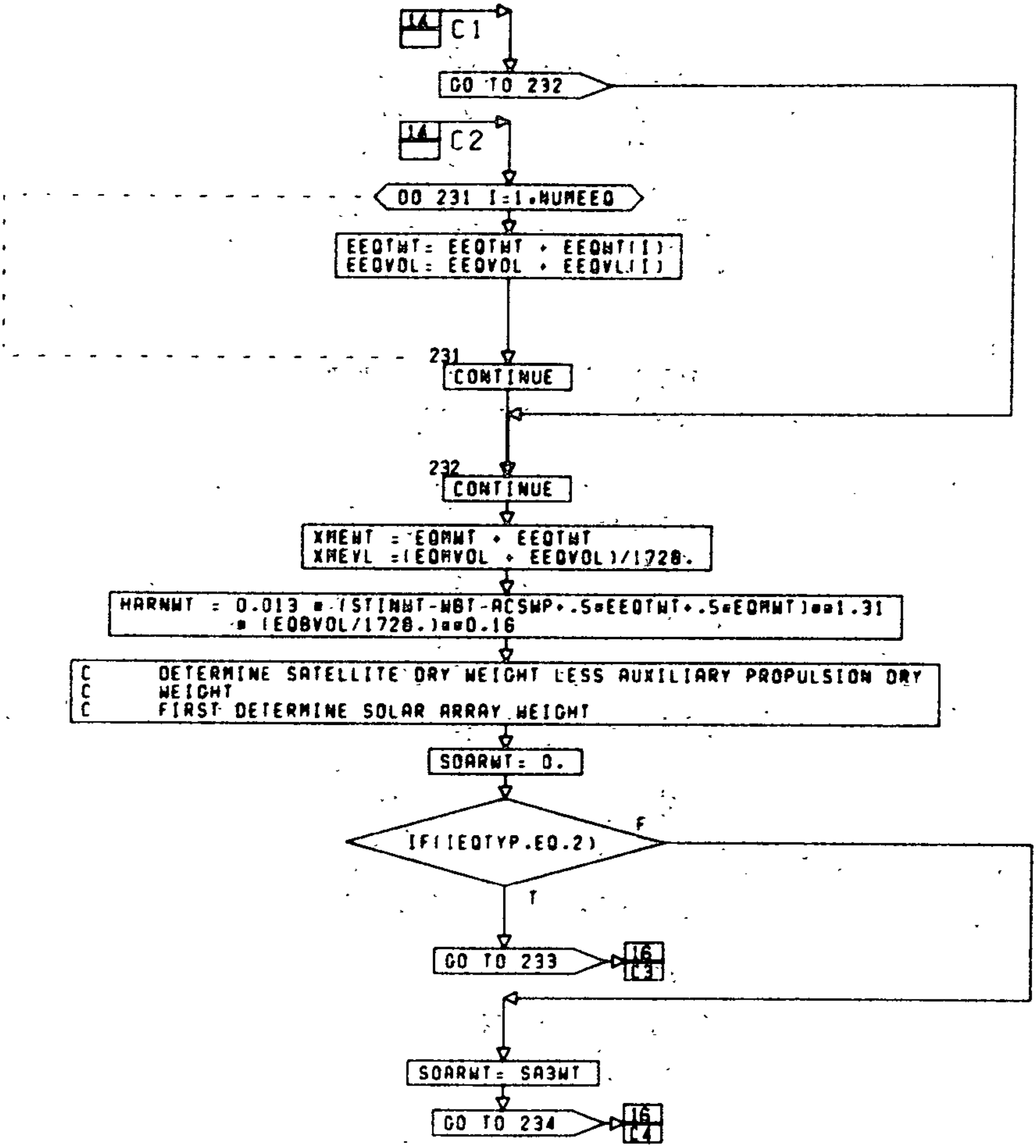

EQM2VL= .785*EQM2YL**2*EQM2XL
GO TO 151
12
B9
150
CONTINUE
EQM1VL= EQM1XL*EQM1YL*EQM1ZL
EQM2VL= EQM2XL*EQM2YL*EQM2ZL
151
CONTINUE
EQMVOL= EQM1VL + EQM2VL
C DETERMINE SA1WT,SA2WT,SA3WT
SA3WT = SOARWT
IF(IEQTYP.EQ.1)
F
T
GO TO 152
SA1WT = .5*SOARWT
SA2WT = SA1WT
152
CONTINUE
C DETERMINE BOOM AND MECHANISM WEIGHT
SABOLG= 0.
SABOOM= 0.
SADRIV= 0.

CONT. ON PG 14



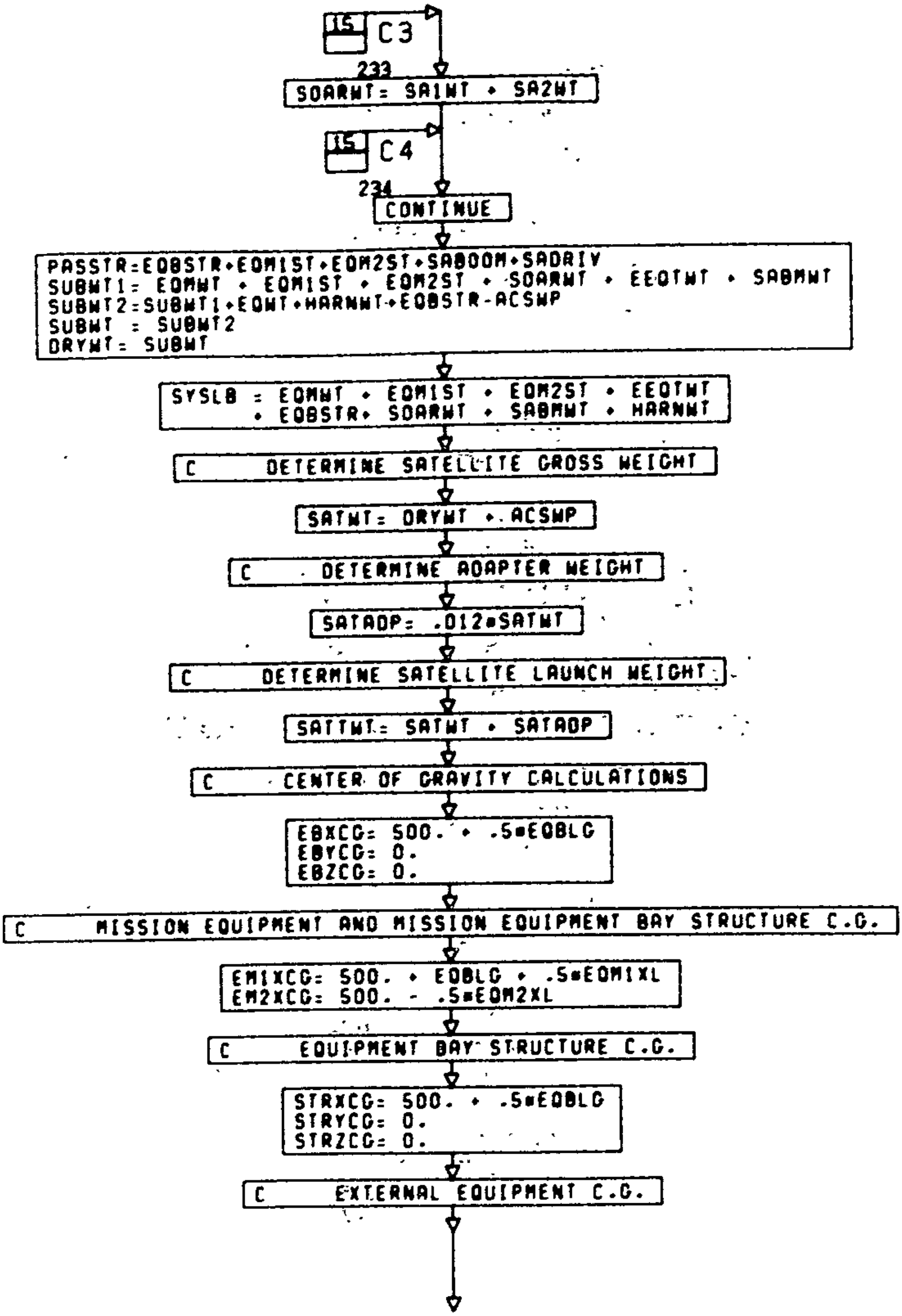
IF(ISPIN.EQ.1)
F
T
GO TO 23
SABOLG= 24.
SABOOM= 15.2
IF(ISBOFG.EQ.0)
F
T
GO TO 23
SADRIV= .166*(SA1WT + SA2WT)
23
CONTINUE
SABMWT= SABOOM + SADRIV
C CALCULATE HARNESS AND STRUCTURAL TPS WEIGHT
C FIRST NEED MISSION EQUIPMENT WEIGHT AND EXTERNAL EQUIPMENT WEIGHT
C AND VOLUME
EQMWT= EQM1WT+ EQM2WT
EEQTWT= 0.
EEQVOL= 0.
IF(NUMEEQ.EQ.0)
F
15
C2
T
15
C1

CONT. ON PG 15

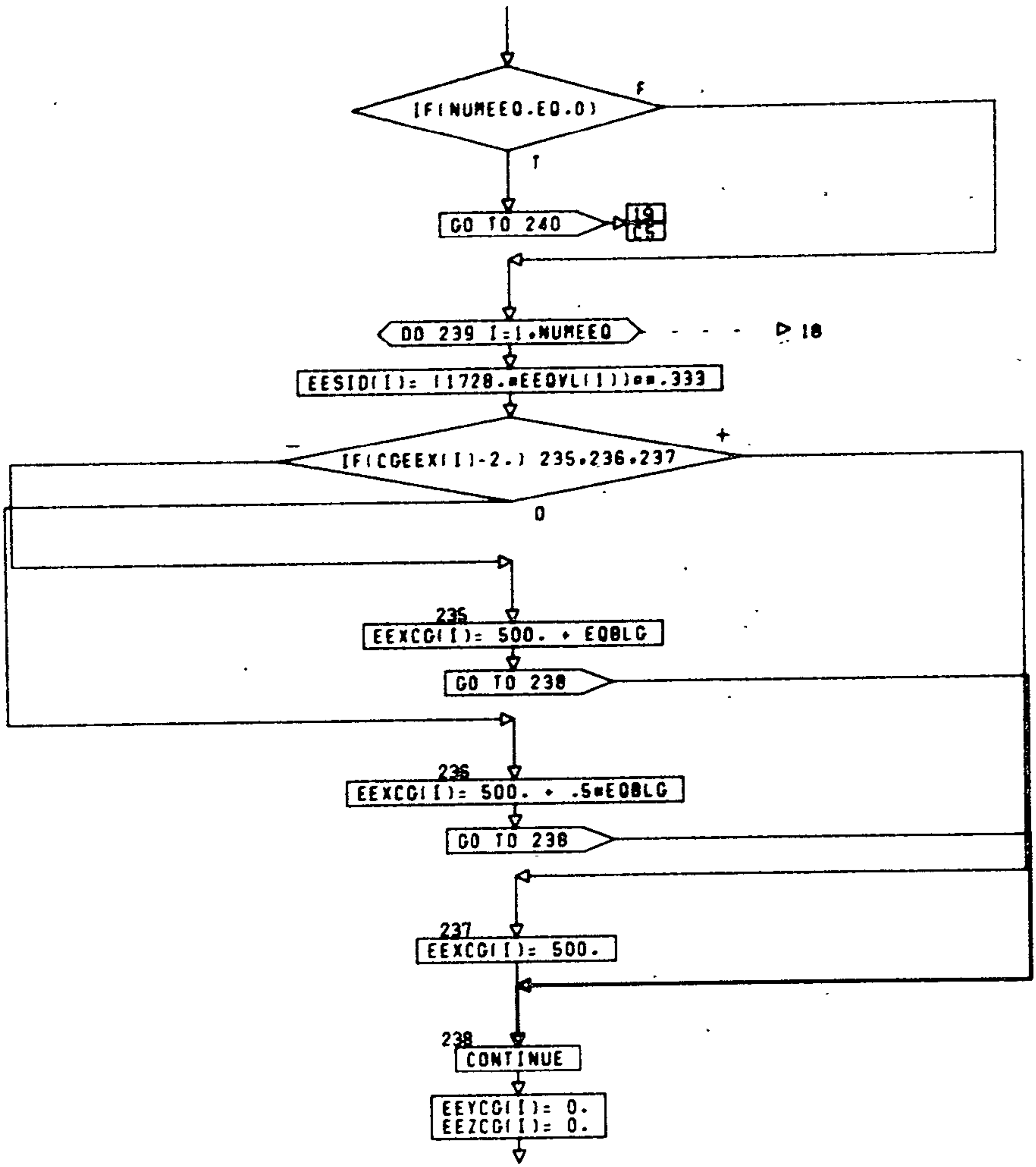


14
C1
GO TO 232
14
C2
DO 231 I=1,NUMEEQ
EEQTWT= EEQTWT + EEQWT(I)
EEQVOL= EEQVOL + EEQVL(I)
231
CONTINUE
232
CONTINUE
XMEWT = EQMWT + EEQTWT
XMEVL =(EQMVOL + EEQVOL)/1728.
HARNWT = 0.013 * (STINWT-WBT-ACSWP+.5*EEQTWT+.5*EQMWT)**1.31
* (EQBVOL/1728.)**0.16
C DETERMINE SATELLITE DRY WEIGHT LESS AUXILIARY PROPULSION DRY
C WEIGHT
C FIRST DETERMINE SOLAR ARRAY WEIGHT
SOARWT= 0.
IF(IEQTYP.EQ.2)
F
T
GO TO 233
16
C3
SOARWT= SA3WT
GO TO 234
16
C4

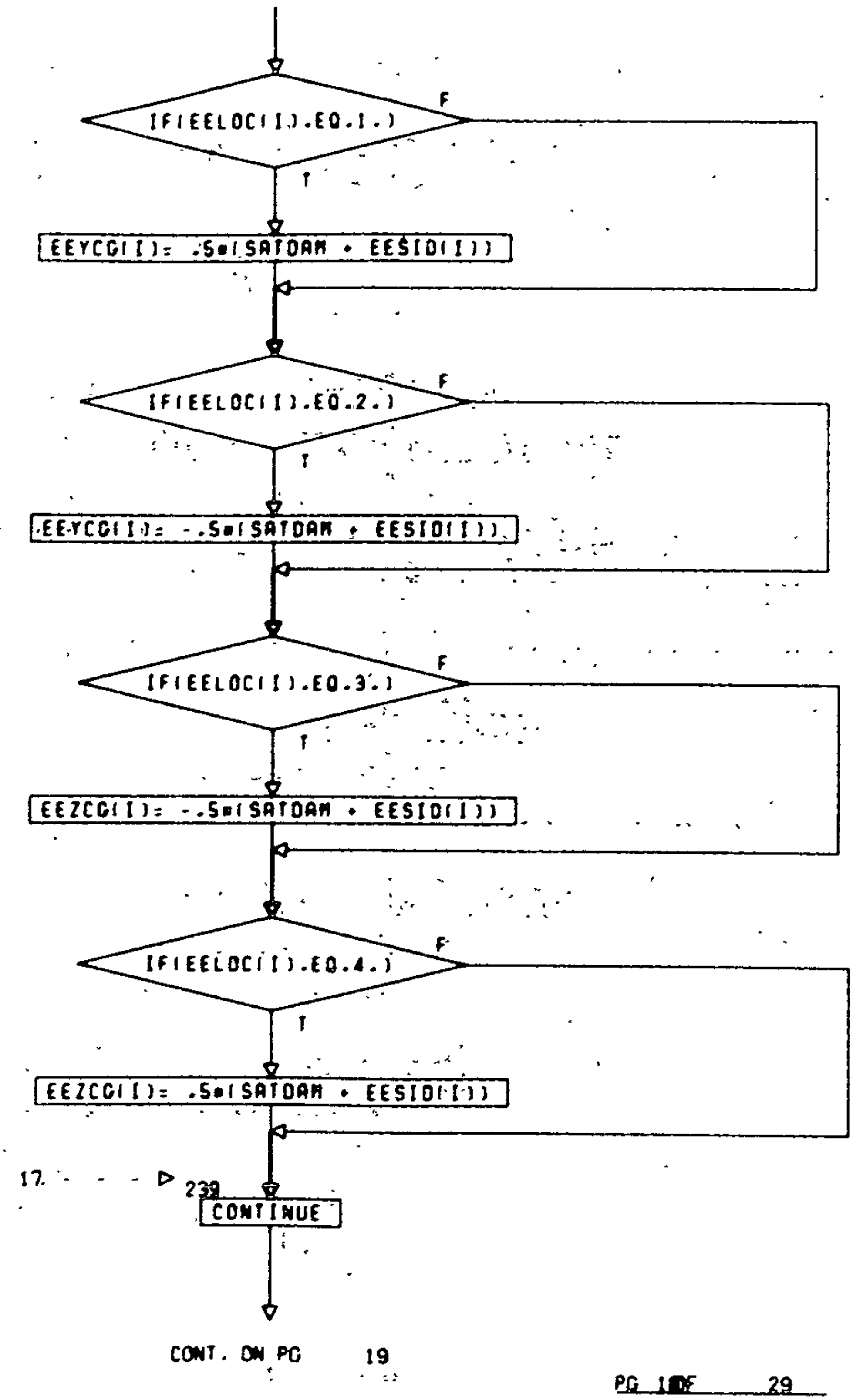
CONT. ON PG 16

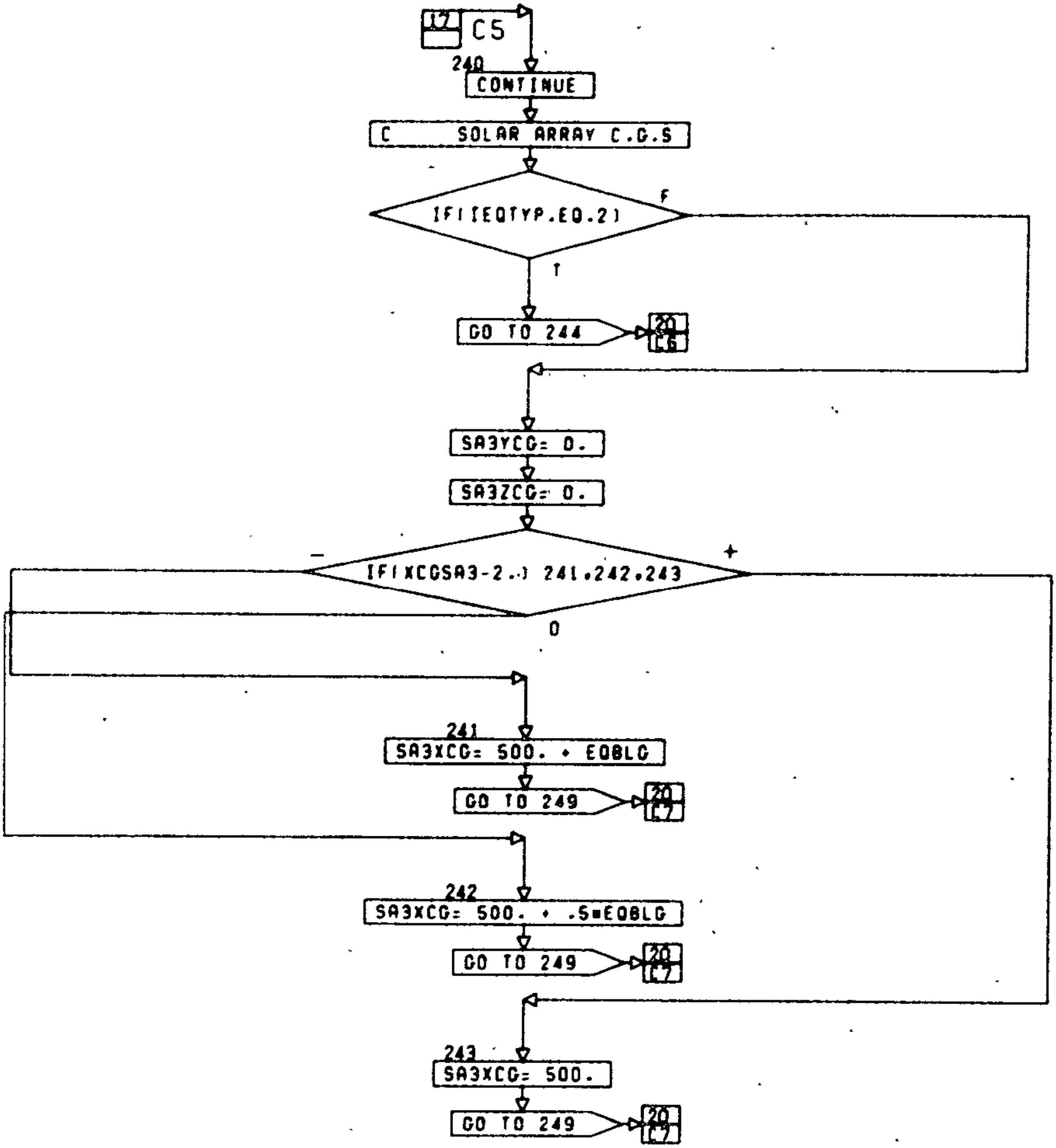

15 C3
233
SOARWT= SA1WT + SA2WT
15 C4
234
CONTINUE
PASSTR=EQBSTR+EQM1ST+EQM2ST+SABOOM+SADRIV
SUBWT1= EQMWT + EQM1ST + EQM2ST + SOARWT + EEQTWT + SABMWT
SUBWT2=SUBWT1+EQWT+HARNWT+EQBSTR-ACSWP
SUBWT = SUBWT2
DRYWT= SUBWT
SYSLB = EQMWT + EQM1ST + EQM2ST + EEQTWT
+ EQBSTR+ SOARWT + SABMWT + HARNWT
C DETERMINE SATELLITE GROSS WEIGHT
SATWT= DRYWT +.ACSWP
C DETERMINE ADAPTER WEIGHT
SATADP= .012*SATWT
C DETERMINE SATELLITE LAUNCH WEIGHT
SATTWT= SATWT + SATADP
C CENTER OF GRAVITY CALCULATIONS
EBXCG= 500. + .5*EQBLG
EBYCG= 0.
EBZCG= 0.
C MISSION EQUIPMENT AND MISSION EQUIPMENT BAY STRUCTURE C.G.
EM1XCG= 500. + EQBLG + .5*EQM1XL
EM2XCG= 500. - .5*EQM2XL
C EQUIPMENT BAY STRUCTURE C.G.
STRXCG= 500. + .5*EQBLG
STRYCG= 0.
STRZCG= 0.
C EXTERNAL EQUIPMENT C.G.

CONT. ON PG 17


IF(NUMEEQ.EQ.0)
F
T
GO TO 240
19
C5
DO 239 I=1,NUMEEQ
18
EESID(I)= (1728.*EEQVL(I))**.333
IF(CGEEX(I)-2.) 235,236,237
-
+
0
235
EEXCG(I)= 500. + EQBLC
GO TO 238
236
EEXCG(I)= 500. + .5*EQBLC
GO TO 238
237
EEXCG(I)= 500.
238
CONTINUE
EEYCG(I)= 0.
EEZCG(I)= 0.

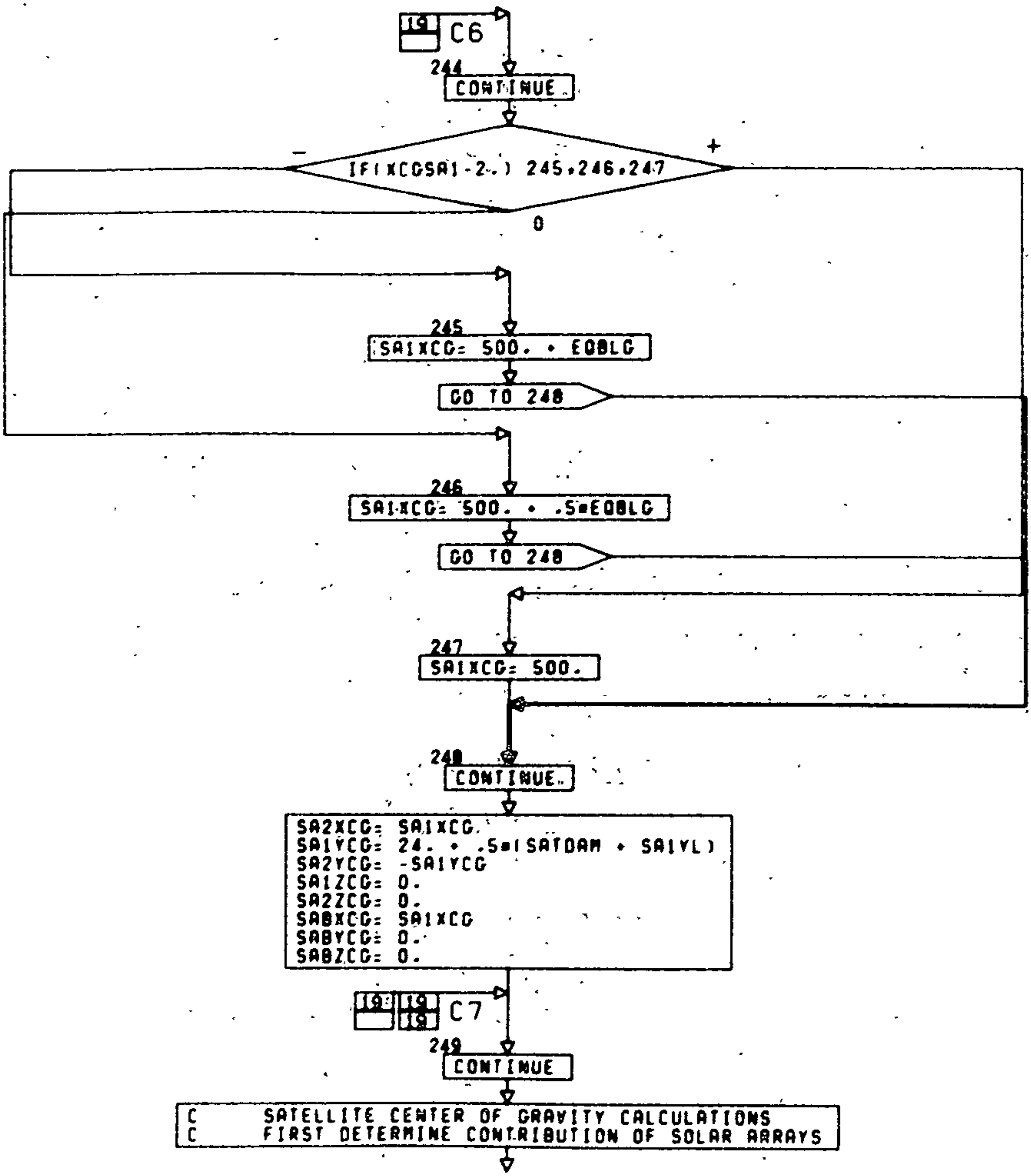
CONT. ON PG 18


IF(EELOC(I).EQ.1.)
F
T
EEYCG(I)= .5*(SATDAM + EESID(I))
IF(EELOC(I).EQ.2.)
F
T
EEYCG(I)= -.5*(SATDAM + EESID(I))
IF(EELOC(I).EQ.3.)
F
T
EEZCG(I)= -.5*(SATDAM + EESID(I))
IF(EELOC(I).EQ.4.)
F
T
EEZCG(I)= .5*(SATDAM + EESID(I))
17
239
CONTINUE
CONT. ON PG 19
PG 18 OF 29

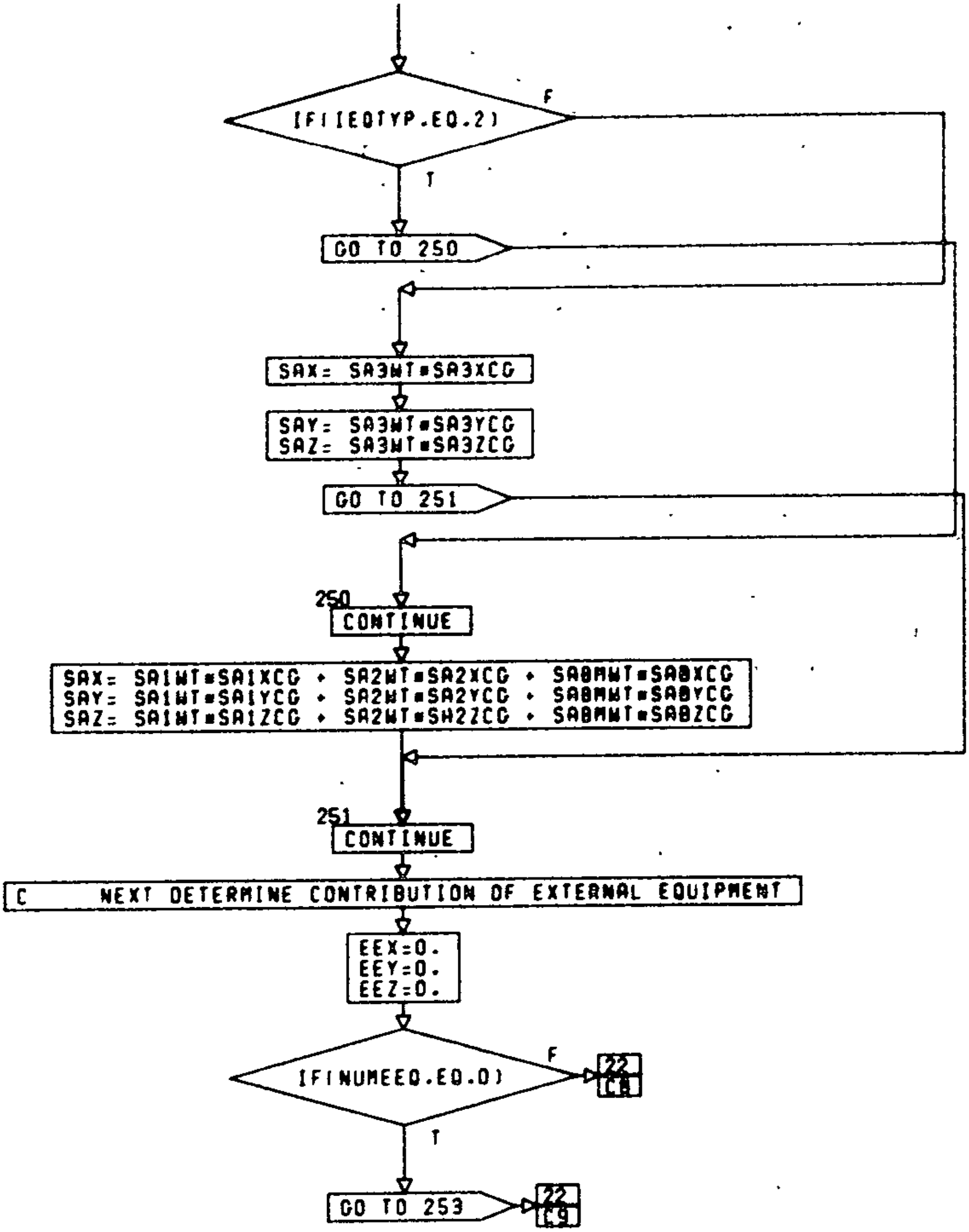


17
C5
240
CONTINUE
C SOLAR ARRAY C.G.S
IF(IEQTYP.EQ.2)
F
T
GO TO 244
20
C6
SA3YCG= 0.
SA3ZCG= 0.
IF(XCGSA3-2.) 241,242,243
-
+
0
241
SA3XCG= 500. + EQBLG
GO TO 249
20
C7
242
SA3XCG= 500. + .5*EQBLG
GO TO 249
20
C7
243
SA3XCG= 500.
GO TO 249
20
C7

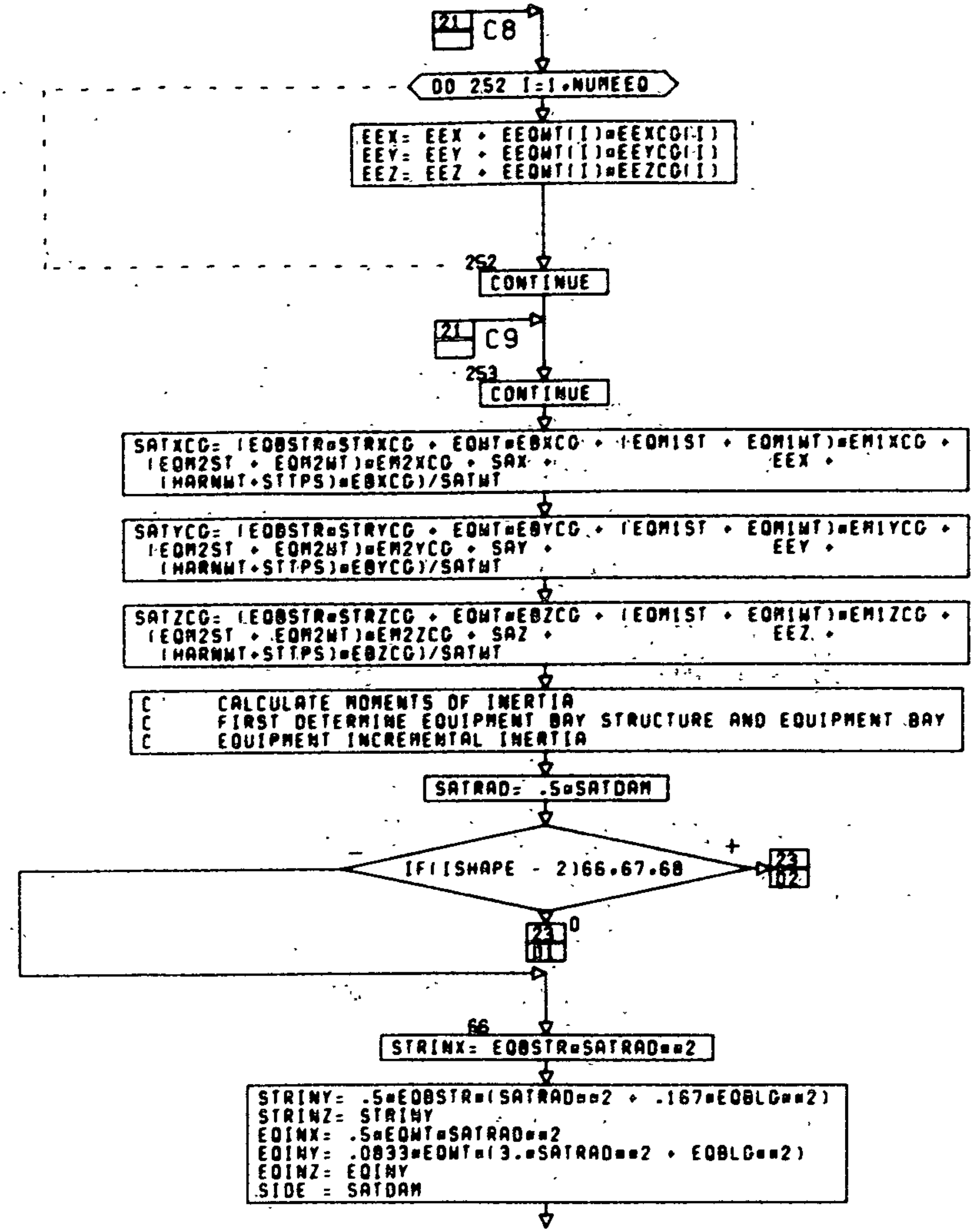
CONT. ON PG 20


C6
244
CONTINUE
IF(XCGSA1-2.) 245,246,247
-
+
0
245
SA1XCG= 500. + EQBLG
GO TO 248
246
SA1XCG= 500. + .5*EQBLG
GO TO 248
247
SA1XCG= 500.
248
CONTINUE
SA2XCG= SA1XCG
SA1YCG= 24. + .5*(SATDAM + SA1YL)
SA2YCG= -SA1YCG
SA1ZCG= 0.
SA2ZCG= 0.
SABXCG= SA1XCG
SABYCG= 0.
SABZCG= 0.
C7
249
CONTINUE
C SATELLITE CENTER OF GRAVITY CALCULATIONS
C FIRST DETERMINE CONTRIBUTION OF SOLAR ARRAYS

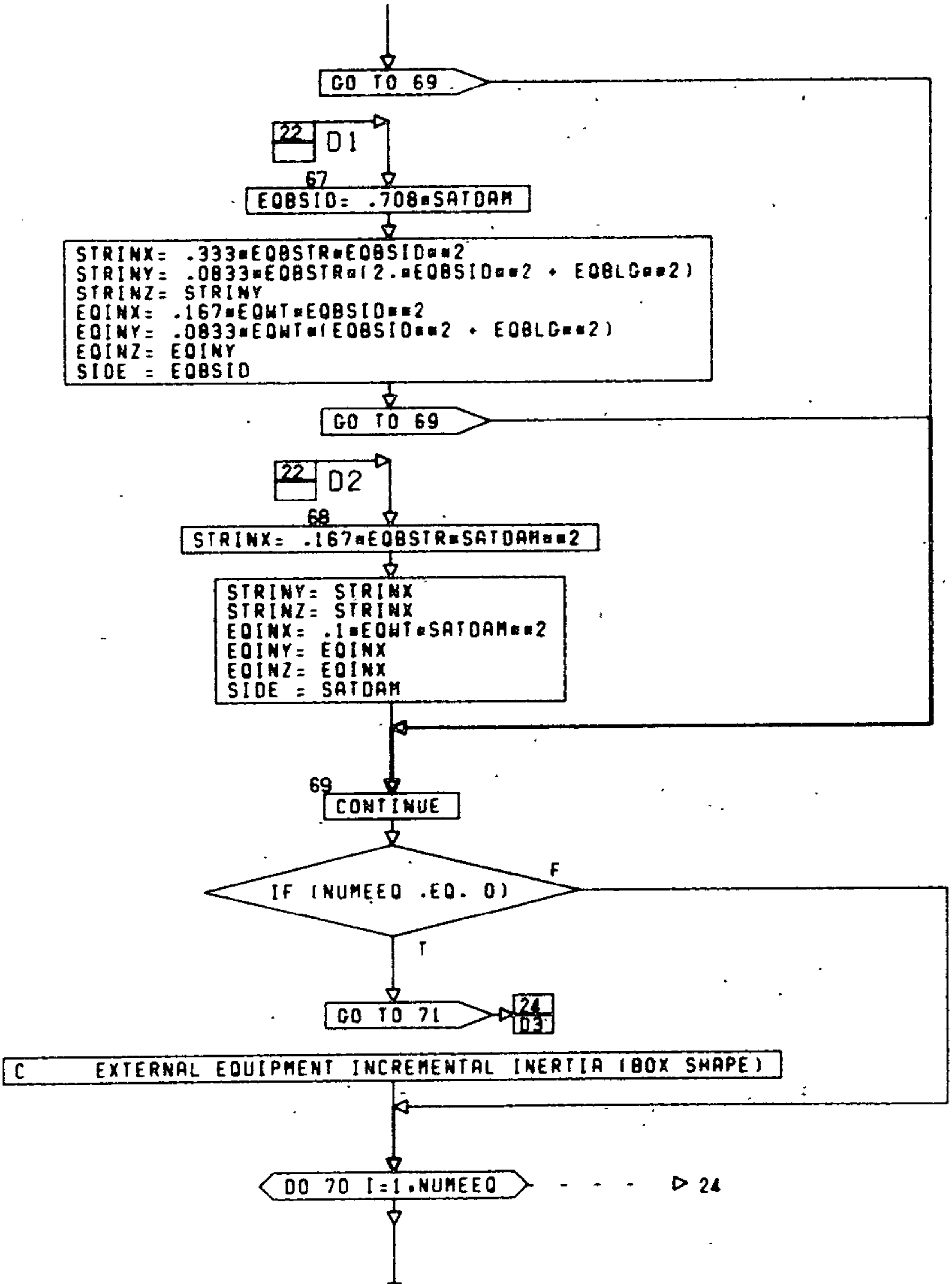
CONT. ON PG 21


IF(IEQTYP.EQ.2)
F
T
GO TO 250
SAX= SA3WT*SA3XCG
SAY= SA3WT*SA3YCG
SAZ= SA3WT*SA3ZCG
GO TO 251
250
CONTINUE
SAX= SA1WT*SA1XCG + SA2WT*SA2XCG + SABMWT*SABXCG
SAY= SA1WT*SA1YCG + SA2WT*SA2YCG + SABMWT*SABYCG
SAZ= SA1WT*SA1ZCG + SA2WT*SA2ZCG + SABMWT*SABZCG
251
CONTINUE
C NEXT DETERMINE CONTRIBUTION OF EXTERNAL EQUIPMENT
EEX=0.
EEY=0.
EEZ=0.
IF(NUMEEQ.EQ.0)
F
22
C8
T
GO TO 253
22
C9

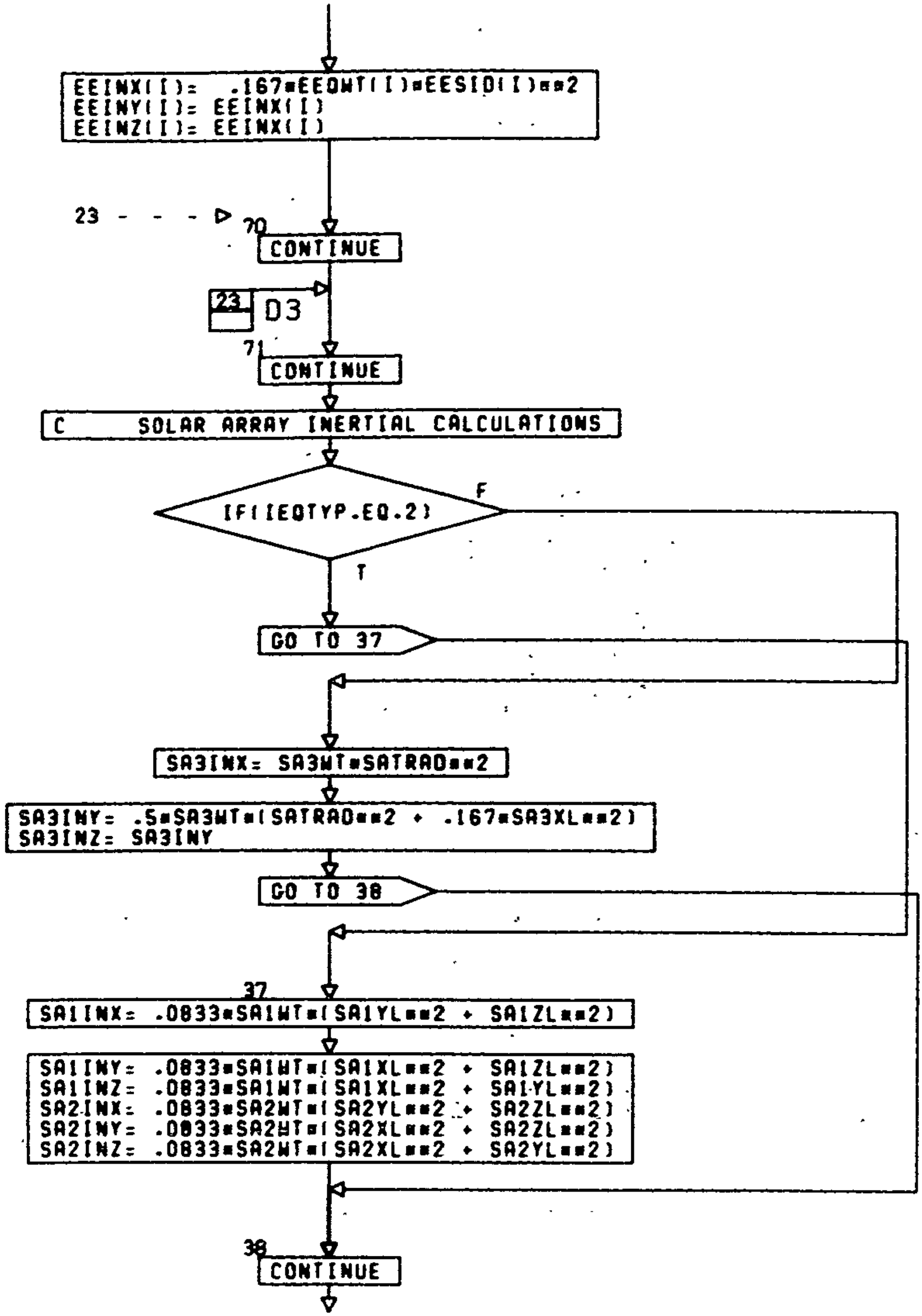
CONT. ON PG 22


21
C8
DO 252 I=1,NUMEEQ
EEX= EEX + EEQWT(I)*EEXCG(I)
EEY= EEY + EEQWT(I)*EEYCG(I)
EEZ= EEZ + EEQWT(I)*EEZCG(I)
252
CONTINUE
21
C9
253
CONTINUE
SATXCG= (EQBSTR*STRXCG + EQWT*EBXCG + (EQM1ST + EQM1WT)*EM1XCG +
(EQM2ST + EQM2WT)*EM2XCG + SAX + EEX +
(HARNWT+STTPS)*EBXCG)/SATWT
SATYCG= (EQBSTR*STRYCG + EQWT*EBYCG + (EQM1ST + EQM1WT)*EM1YCG +
(EQM2ST + EQM2WT)*EM2YCG + SAY + EEY +
(HARNWT+STTPS)*EBYCG)/SATWT
SATZCG= (EQBSTR*STRZCG + EQWT*EBZCG + (EQM1ST + EQM1WT)*EM1ZCG +
(EQM2ST + EQM2WT)*EM2ZCG + SAZ + EEZ +
(HARNWT+STTPS)*EBZCG)/SATWT
C CALCULATE MOMENTS OF INERTIA
C FIRST DETERMINE EQUIPMENT BAY STRUCTURE AND EQUIPMENT BAY
C EQUIPMENT INCREMENTAL INERTIA
SATRAD= .5*SATDAM
IF(ISHAPE - 2)66,67,68
−
+
0
23
102
23
101
66
STRINX= EQBSTR*SATRAD**2
STRINY= .5*EQBSTR*(SATRAD**2 + .167*EQBLG**2)
STRINZ= STRINY
EQINX= .5*EQWT*SATRAD**2
EQINY= .0833*EQWT*(3.*SATRAD**2 + EQBLG**2)
EQINZ= EQINY
SIDE = SATDAM

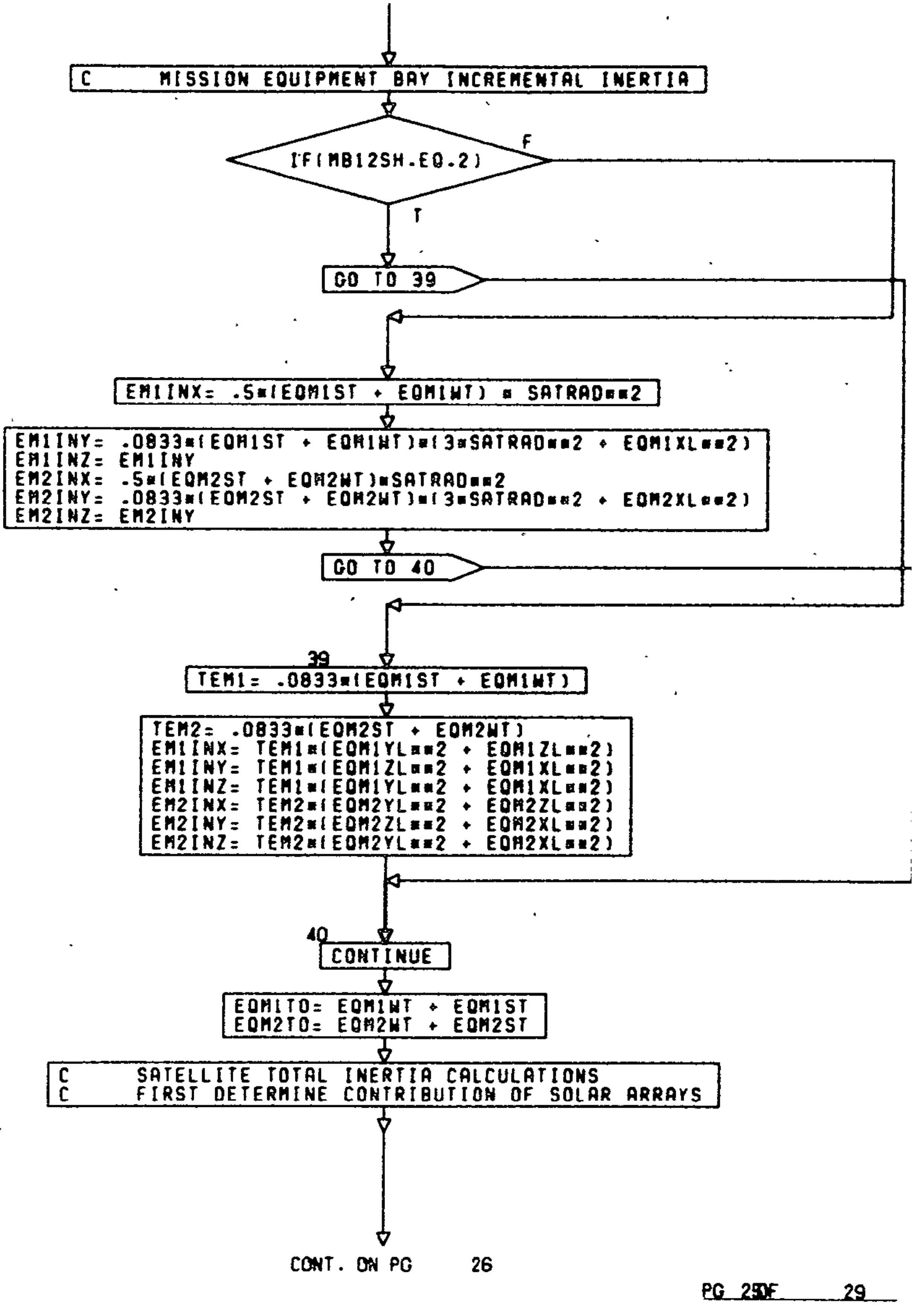
CONT. ON PG 23


GO TO 69
22
D1
67
EQBSID= .708*SATDAM
STRINX= .333*EQBSTR*EQBSID**2
STRINY= .0833*EQBSTR*(2.*EQBSID**2 + EQBLG**2)
STRINZ= STRINY
EQINX= .167*EQWT*EQBSID**2
EQINY= .0833*EQWT*(EQBSID**2 + EQBLG**2)
EQINZ= EQINY
SIDE = EQBSID
GO TO 69
22
D2
68
STRINX= .167*EQBSTR*SATDAM**2
STRINY= STRINX
STRINZ= STRINX
EQINX= .1*EQWT*SATDAM**2
EQINY= EQINX
EQINZ= EQINX
SIDE = SATDAM
69
CONTINUE
IF (NUMEEQ .EQ. 0)
F
T
GO TO 71
24
D3
C EXTERNAL EQUIPMENT INCREMENTAL INERTIA (BOX SHAPE)
DO 70 I=1,NUMEEQ
24

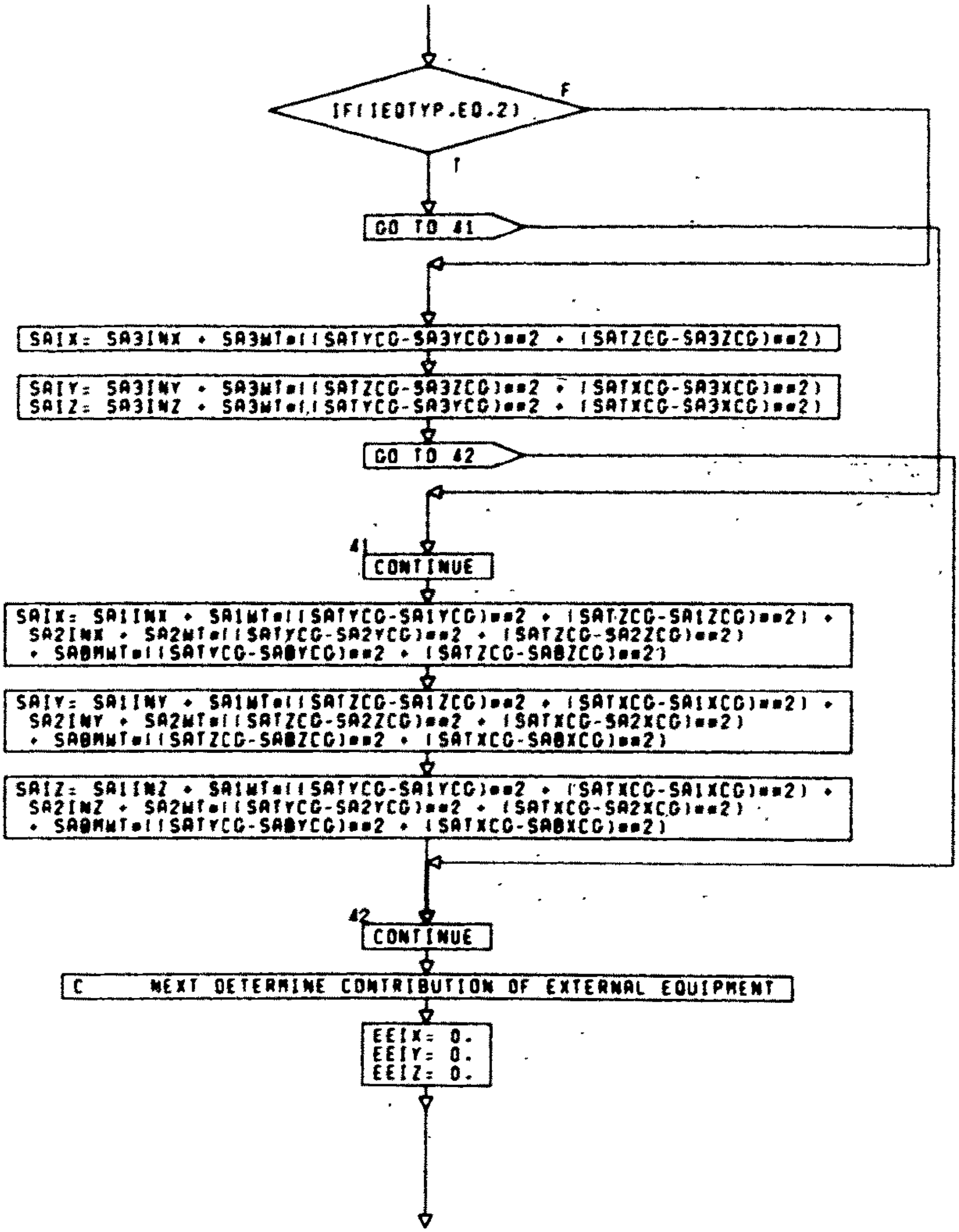
CONT. ON PG 24


EEINX(I)= .167*EEQWT(I)*EESID(I)**2
EEINY(I)= EEINX(I)
EEINZ(I)= EEINX(I)
23
70
CONTINUE
23
D3
71
CONTINUE
C SOLAR ARRAY INERTIAL CALCULATIONS
IF(IEQTYP.EQ.2)
F
T
GO TO 37
SA3INX= SA3WT*SATRAD**2
SA3INY= .5*SA3WT*(SATRAD**2 + .167*SA3XL**2)
SA3INZ= SA3INY
GO TO 38
37
SA1INX= .0833*SA1WT*(SA1YL**2 + SA1ZL**2)
SA1INY= .0833*SA1WT*(SA1XL**2 + SA1ZL**2)
SA1INZ= .0833*SA1WT*(SA1XL**2 + SA1YL**2)
SA2INX= .0833*SA2WT*(SA2YL**2 + SA2ZL**2)
SA2INY= .0833*SA2WT*(SA2XL**2 + SA2ZL**2)
SA2INZ= .0833*SA2WT*(SA2XL**2 + SA2YL**2)
38
CONTINUE

CONT. ON PG 25


C MISSION EQUIPMENT BAY INCREMENTAL INERTIA
IF(MB12SH.EQ.2)
F
T
GO TO 39
EM1INX= .5*(EQM1ST + EQM1WT) * SATRAD**2
EM1INY= .0833*(EQM1ST + EQM1WT)*(3*SATRAD**2 + EQM1XL**2)
EM1INZ= EM1INY
EM2INX= .5*(EQM2ST + EQM2WT)*SATRAD**2
EM2INY= .0833*(EQM2ST + EQM2WT)*(3*SATRAD**2 + EQM2XL**2)
EM2INZ= EM2INY
GO TO 40
39
TEM1= .0833*(EQM1ST + EQM1WT)
TEM2= .0833*(EQM2ST + EQM2WT)
EM1INX= TEM1*(EQM1YL**2 + EQM1ZL**2)
EM1INY= TEM1*(EQM1ZL**2 + EQM1XL**2)
EM1INZ= TEM1*(EQM1YL**2 + EQM1XL**2)
EM2INX= TEM2*(EQM2YL**2 + EQM2ZL**2)
EM2INY= TEM2*(EQM2ZL**2 + EQM2XL**2)
EM2INZ= TEM2*(EQM2YL**2 + EQM2XL**2)
40
CONTINUE
EQM1TO= EQM1WT + EQM1ST
EQM2TO= EQM2WT + EQM2ST
C SATELLITE TOTAL INERTIA CALCULATIONS
C FIRST DETERMINE CONTRIBUTION OF SOLAR ARRAYS

CONT. ON PG 26

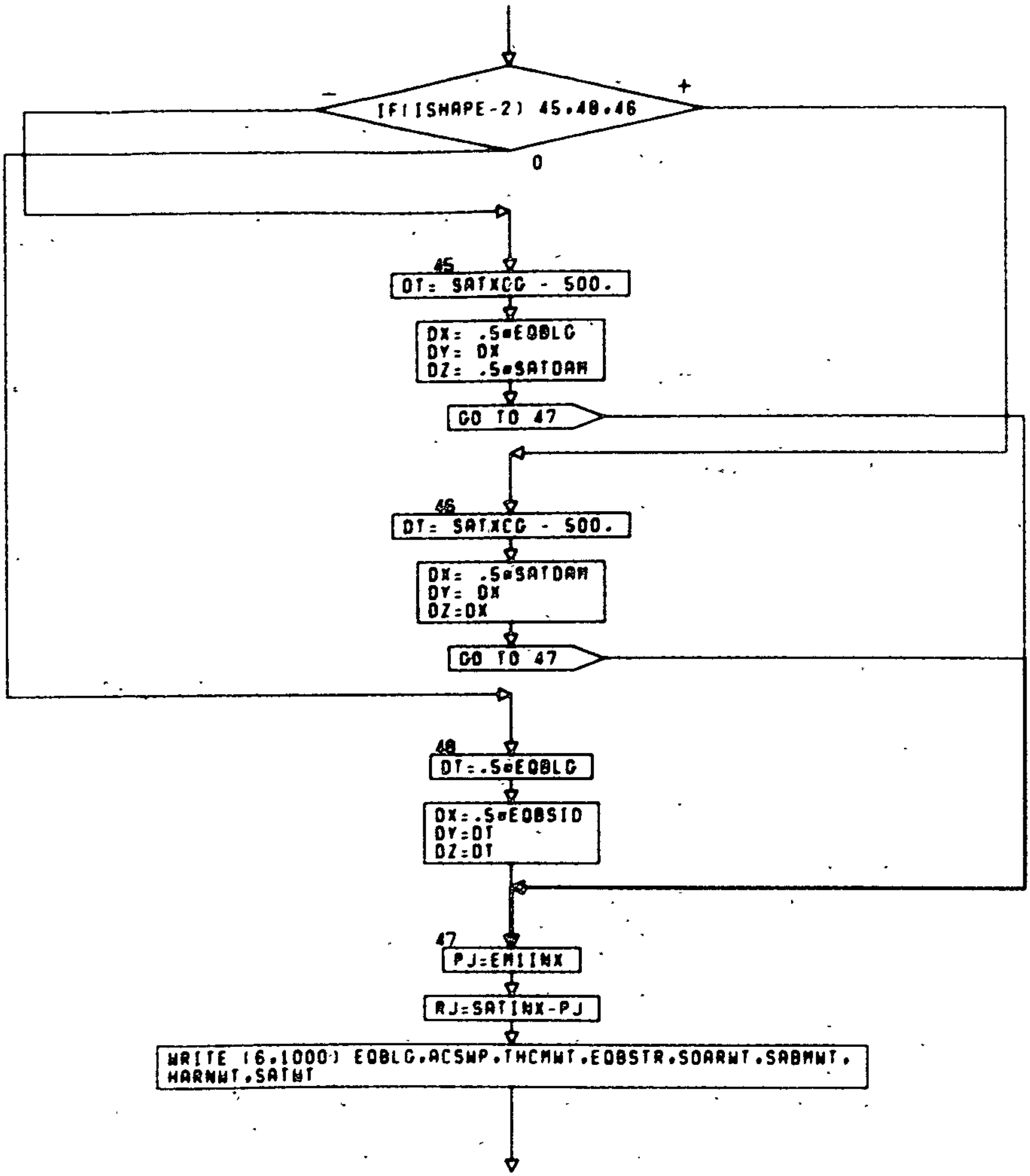


IF(IEQTYP.EQ.2)
F
T
GO TO 41
SAIX= SA3INX + SA3WT*((SATYCG-SA3YCG)**2 + (SATZCG-SA3ZCG)**2)
SAIY= SA3INY + SA3WT*((SATZCG-SA3ZCG)**2 + (SATXCG-SA3XCG)**2)
SAIZ= SA3INZ + SA3WT*((SATYCG-SA3YCG)**2 + (SATXCG-SA3XCG)**2)
GO TO 42
41
CONTINUE
SAIX= SA1INX + SA1WT*((SATYCG-SA1YCG)**2 + (SATZCG-SA1ZCG)**2) +
SA2INX + SA2WT*((SATYCG-SA2YCG)**2 + (SATZCG-SA2ZCG)**2)
+ SA0MWT*((SATYCG-SA0YCG)**2 + (SATZCG-SA0ZCG)**2)
SAIY= SA1INY + SA1WT*((SATZCG-SA1ZCG)**2 + (SATXCG-SA1XCG)**2) +
SA2INY + SA2WT*((SATZCG-SA2ZCG)**2 + (SATXCG-SA2XCG)**2)
+ SA0MWT*((SATZCG-SA0ZCG)**2 + (SATXCG-SA0XCG)**2)
SAIZ= SA1INZ + SA1WT*((SATYCG-SA1YCG)**2 + (SATXCG-SA1XCG)**2) +
SA2INZ + SA2WT*((SATYCG-SA2YCG)**2 + (SATXCG-SA2XCG)**2)
+ SA0MWT*((SATYCG-SA0YCG)**2 + (SATXCG-SA0XCG)**2)
42
CONTINUE
C NEXT DETERMINE CONTRIBUTION OF EXTERNAL EQUIPMENT
EEIX= 0.
EEIY= 0.
EEIZ= 0.

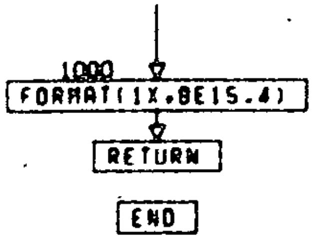
CONT. ON PG 27

```
        IF(NUMEEQ.EQ.0)      F --> (to entry before DO 43)
             | T
        GO TO 44  --> (to 44)

      DO 43 I=1,NUMEEQ
        EEIX= EEIX + EEINX(I) + EEQWT(I)*((SATYCG-EEYCG(I))**2 +
          (SATZCG-EEZCG(I))**2)
        EEIY= EEIY + EEINY(I) + EEQWT(I)*((SATZCG-EEZCG(I))**2 +
          (SATXCG-EEXCG(I))**2)
        EEIZ= EEIZ + EEINZ(I) + EEQWT(I)*((SATYCG-EEYCG(I))**2 +
          (SATXCG-EEXCG(I))**2)
   43 CONTINUE

   44 CONTINUE
      SATINX= STRINX + EQBSTR*((SATYCG-STRYCG)**2 + (SATZCG-STRZCG)**2)
       + EM1INX + EQM1TO*((SATYCG-EM1YCG)**2 + (SATZCG-EM1ZCG)**2)
       + EM2INX + EQM2TO*((SATYCG-EM2YCG)**2 + (SATZCG-EM2ZCG)**2)
       + EQINX + EQWT*(SATYCG**2 + SATZCG**2) + SAIX + EEIX
      SATINY= STRINY + EQBSTR*((SATZCG-STRZCG)**2 + (SATXCG-STRXCG)**2)
       + EM1INY + EQM1TO*((SATZCG-EM1ZCG)**2 + (SATXCG-EM1XCG)**2)
       + EM2INY + EQM2TO*((SATZCG-EM2ZCG)**2 + (SATXCG-EM2XCG)**2)
       + EQINY + EQWT*(SATZCG**2 + (SATXCG-STRXCG)**2) + SAIY + EEIY
      SATINZ= STRINZ + EQBSTR*((SATYCG-STRYCG)**2 + (SATXCG-STRXCG)**2)
       + EM1INZ + EQM1TO*((SATYCG-EM1YCG)**2 + (SATXCG-EM1XCG)**2)
       + EM2INZ + EQM2TO*((SATYCG-EM2YCG)**2 + (SATXCG-EM2XCG)**2)
       + EQINZ + EQWT*(SATYCG**2 + (SATXCG-STRXCG)**2) + SAIZ + EEIZ
C     COMPUTE DISTANCE FROM C.G. TO MAIN ENGINE(DT), GAS JET LEVER ARMS
C     ON ROLL, PITCH, AND YAW AXES, RESPECTIVELY, (DX,DY,DZ).  THE
C     CONVERSION TO UNITS OF FT IS DONE IN SUBROUTINE SANDC
```

CONT. ON PG 28


IF(ISHAPE-2) 45,48,46
-
+
0
45
DT= SATXCG - 500.
DX= .5*EQBLG
DY= DX
DZ= .5*SATDAM
GO TO 47
46
DT= SATXCG - 500.
DX= .5*SATDAM
DY= DX
DZ=DX
GO TO 47
48
DT=.5*EQBLG
DX=.5*EQBSID
DY=DT
DZ=DT
47
PJ=EMIINX
RJ=SATINX-PJ
WRITE (6,1000) EQBLG,ACSWP,THCMWT,EQBSTR,SOARWT,SABMWT,
HARNWT,SATWT

CONT. ON PG 29



PG 29 FINAL

```
      SUBROUTINE EP (IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)

C ***********************************************************************
C *    SUBROUTINE EP - -                                                *
C *        WILL SELECT AND SIZE THE ELECTRICAL SUBSYSTEM WHICH WILL BE  *
C *        THESE CONFIGURATIONS AS FOLLOWS - -                          *
C *                     NCONF (1) = 1    IS   DUAL SPIN                 *
C *                     NCONF (1) = 2    IS   YAW SPIN                  *
C *                     NCONF (1) = 3    IS   MASS EXPULSION            *
C *                     NCONF (1) = 4    IS   MASS EXPULSION(MOMENTUM BIAS) *

C *                     NCONF (1) = 5    IS   PITCH MOMENTUM BIAS       *
C *                     NCONF (5) = 1    IS   SHUNT   -   PADDLE        *
C *                     NCONF (5) = 2    IS   SHUNT   -   BODY          *
C *                     NCONF (5) = 3    IS   S + D -     PADDLE        *
C *                     NCONF (5) = 4    IS   S + D -     BODY          *
C *                     NCONF (5) = 5    IS   SERIES      PADDLE        *
C *                     NCONF (5) = 6    IS   SERIES      BODY          *
C *                     NCONF (6) = 1    IS   CYLINDER                  *

C *                     NCONF (6) = 2    IS   BOX                       *
C *                     NCONF (6) = 3    IS   SPHERE                    *
C ***********************************************************************
C *      A LIST OF THE VARIABLES FOLLOWS - -                            *
C *                                                                     *
C *      VARIABLE   HOW USED  FROM      TO        DEFAULT   DESCRIPTION*
C *                                                                     *
C *      A          INT       EP        EP                  FT HE + HP  *

C *      A1         INT       EPS       EPS              FT**2 ARRAY AREA*
C *      A32        INT       EP        EP                    A**(3/2)  *
C *      ALT        I,INT     USER      EPR                   MI ALTITUDE *
C *      AREA       O         EPS       VESIZE           FT**2 ARRAY AREA*
C *      CA         INT       EPS       EPS                 A-H MIN REQ CP*
C *      CAPMAX     INT       DB        EPR                 A-H MIN REQ CP*
C *      CCELL      INT       DB        EPS                 A-H CAP SEL CL*
C *      CHMINT     INT       EPS       EPS       2.0       HRS MIN CHG TM*

C *      CI         INT       EPS       EPS                 A-HMIN INST CP*
C *      CISTAR     INT       EPS       EPS                 A-HCAP SEL CEL*
C *      CR         INT       EPS       EPS                 W-HMIN REQ CAP*
C *      DATAB      I,INT,O   MAIN      EPR,EPS                DATA BASE *
C *      DELF       INT       EPS       EPS       .03          XMIS LOSS *
C *      DELI       INT       EPS       EPS       .02          FAB LOSS  *
C *      DELM       INT       EPS       EPS       .01          MISC LOSS *
C *      DELR       INT       EPS       EPS       .05 OR .3 RAD DEG FAC*

C *      DELT       INT       EPS       EPS       TABLE     TEMP.CORR. *
C *      ETAC       INT       DB        EPR       1.0       EFF CHGR   *
C *      ETAD       INT       DB        EPR,EPS   0.85      EFF DISCH  *
C *      ETAE       INT       DB        EPR,EPS   0.65      EFF BATT   *
C *      ETAI       INT       EPS       EPS       0.105     SOLAR CL EF*
C *      ETALR      INT       DB        EPR       0.90      EFF LD REG *
C *      ETAR       INT       EPR       EPR,EPS   1.0       PWR DIST LS*
C *      FS         INT       EPS       EPS       -         SIZE FACT. *
```

CONT. ON PG 2

```
C *        FW        INT        EPS          EPS          -             WT FACTOR   *
C *        HE        INT        EP           EP           20.902E6FT    RAD EARTH   *
C *        HEDA      INT        EP           EP                         HE/A        *
C *        HP        INT        EP           EP                         FT PERIGEE  *
C *        I         INT        EP           EP                         INT INDEX   *
C *        ICCU      INT        EPR          EPR                        CCU INDEX   *
C *        ICELL     INT        EPS          EPS                        COL INDX CL *
C *        ICELLE    INT        EPS          EPS                        END CELLS   *
```

```
C *        ICH       INT        EPR          EPR                        AMP CHG CURR *
C *        ICHGR     INT        EPR          EPR                        COL INDX CH *
C *        ICHGRE    INT        EPS          EPS                        END CHGRS   *
C *        ICHOSE    O          EPR,EPS      MAIN                       HDWR ID     *
C *        ICONF     INT        EPR,EPS      EPR,EPS                    VAR ON CONF *
C *        IDB       I          MAIN         EPR,EPS                    LAST HDWR   *
C *        IDR       INT        EPR          EPR                        COL INDX DR *
C *        IDRE      INT        EPR          EPR                        END DISCH   *
```

```
C *        IERR      O          EPR          MAIN                       ERROR FLG   *
C *        ILR       INT        EPR          EPR                        COL INDX LR *
C *        ILRE      INT        EPR          EPR                        END LR      *
C *        IPCU      INT        EPR          EPR                        PCU INDEX   *
C *        IPCUE     INT        EPR          EPR                        END PCU     *
C *        IPD       INT        EPR          EPR                        PD INDEX    *
C *        IPDE      INT        EPR          EPR                        END PD      *
C *        IPIC      I,O        EPR,EPS      MAIN                       HDWR INDEX  *
```

```
C *        ISPD      INT        EPR          EPR                        SPD INDEX   *
C *        ISPDE     INT        EPR          EPR                        END SPD     *
C *        ISR1      INT        EPR          EPR                        SR1 INDEX   *
C *        ISR1E     INT        EPR          EPR                        END SR1     *
C *        ISR2      INT        EPR          EPR                        SR2 INDEX   *
C *        ISR2E     INT        EPR          EPR                        END SR2     *
C *        K1        INT        EPS          EPS          1.02          BATT PKG F  *
C *        K2        INT        EPS          EPS          1.4           BAT ST WT F *
```

```
C *        LMBDD     INT,O      EPR          EPR,REL      0.3           AV DP DISCH *
C *        LMBDG     INT        EPS          EPS          -             ORINT FACT  *
C *        LMBDP     INT        EPS          EPS          0.9           SLR PKG FAC *
C *        MU        INT        EP           EP           1.408E16      CONSTANT    *
C *        N         INT        EP           EP                         EARTH RATE  *
C *        NB        INT        EPS          EPS          2             NO BATT     *
C *        NC        INT        EPS          EPS                        NO SLR CELL *
C *        NCCU      INT        EPR          EPR                        NO.CCU      *
```

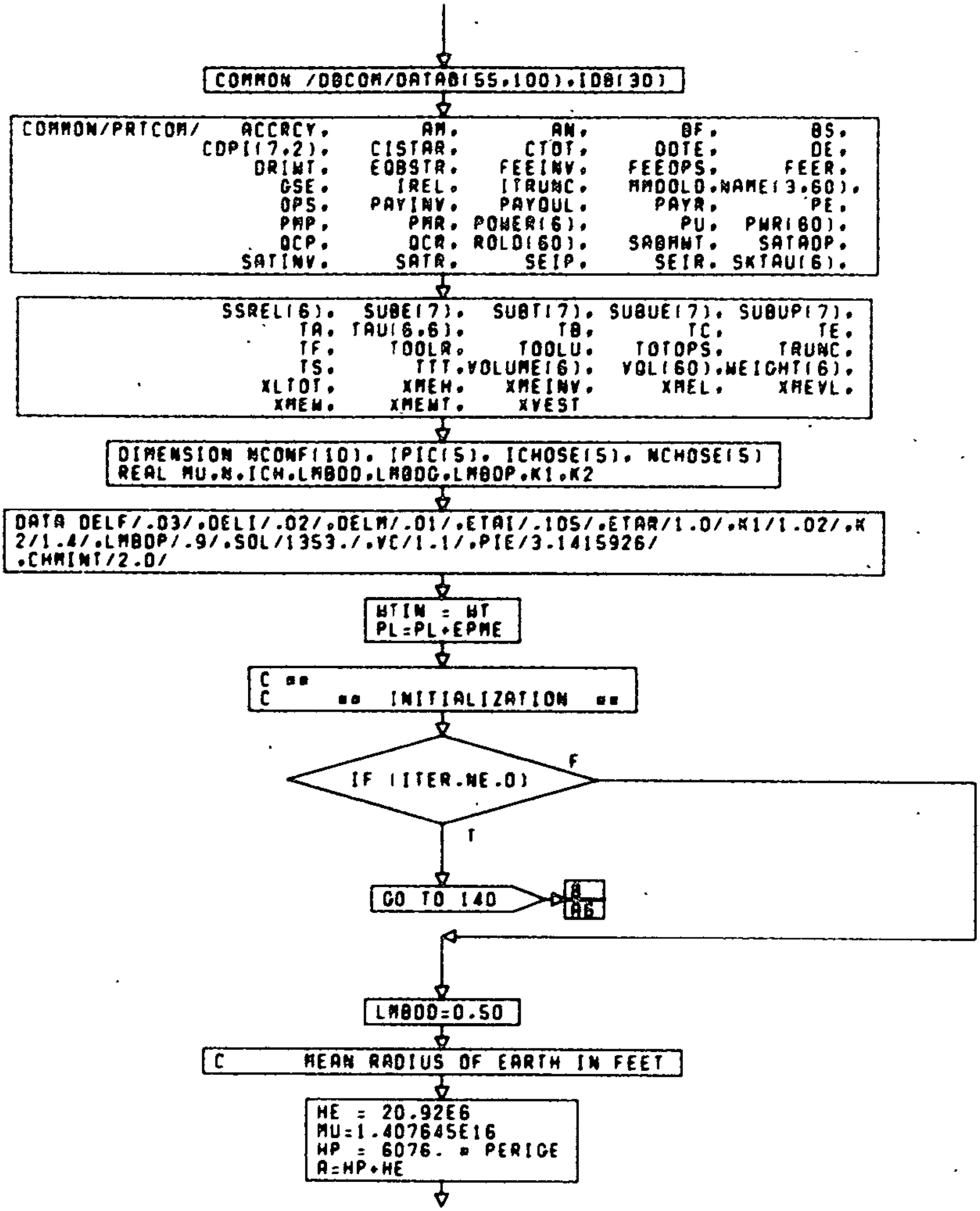
```
C *        NCH       INT        EPS          EPS          2             NO CHGRS    *
C *        NCHOSE    O          EPR,EPS      MAIN                       NO. EQUIP.  *
C *        NCONF(1)  I,EPS,O    MAIN         EPS,MAIN                   SANDC MACRO *
C *        NCONF(5)  I,EP ,O    MAIN         EP ,MAIN                   EP  MACRO   *
C *        NCONF(6)  I,EPS,O    MAIN         EPS,MAIN                   VSIZE MACRO *
C *        ND        INT        EPR          EPR                        NO DISCH RG *
C *        NLR       INT        EPR          EPR                        NO LD REG   *
C *        NPCU      INT        EPR          EPR                        NO.PCU      *
```

```
C *        NPD       INT        EPR          EPR                        NO. PD      *
C *        NSPD      INT        EPR          EPR                        NO. SPD     *
```

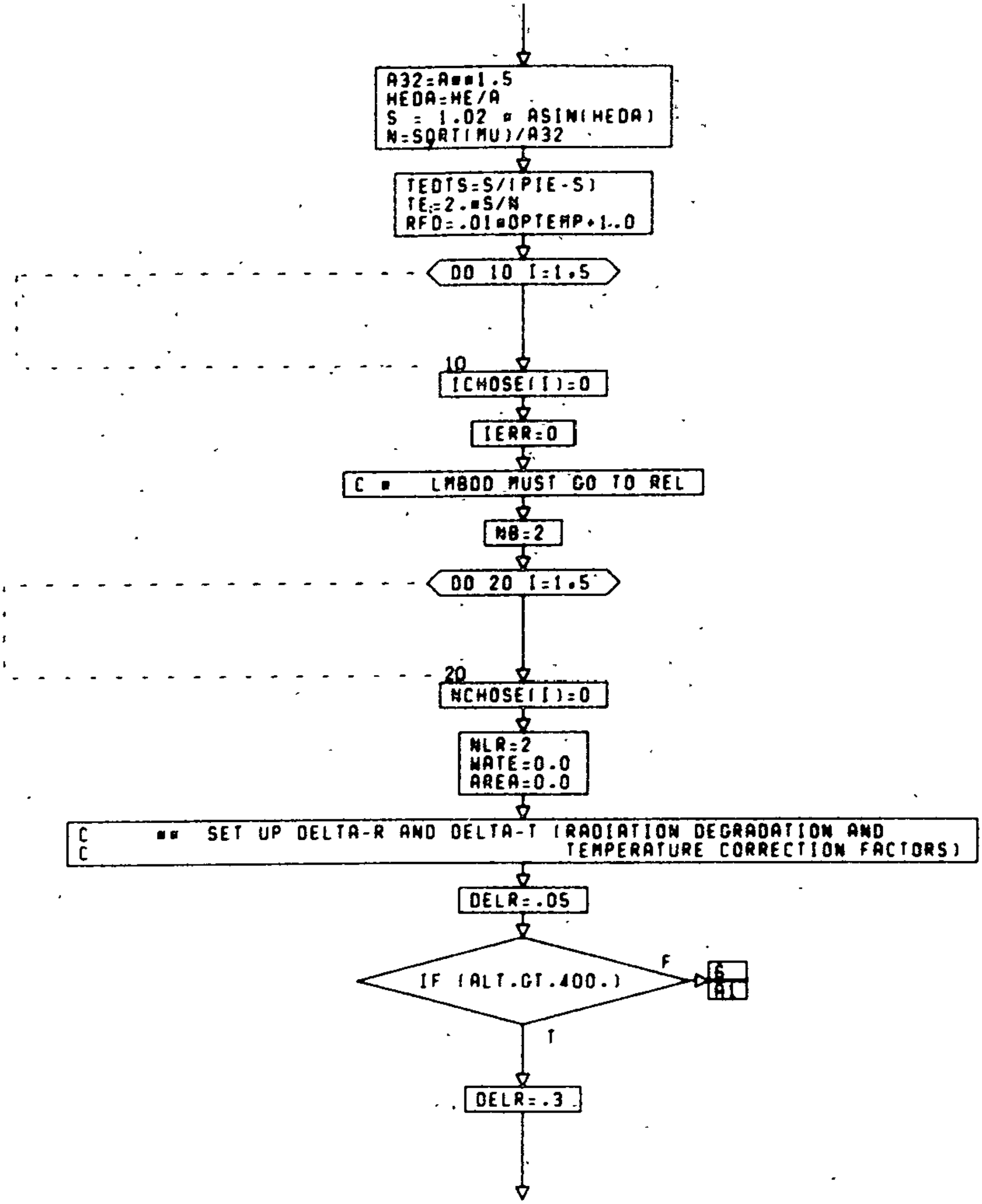
CONT. ON PG 3

```
C *        NSR          INT       EPR         EPR                   NO SHNT REG*
C *        OPTEMP       I         USER        EP          15. DEG. C BAT TEMP  *
C *        PBOL         INT       EPR         EPR,EPS         WATTPWR B.O.L.   *
C *        PD           INT       EPR         EPR             WATTBAT PWR-REG*
C *        PEXCES       INT       EPR         EPR,EPS         WATTPWD 28 DISP*
C *        PIE          INT       EPS         EPS         3.14159   CONSTANT   *

C *        PL           I         ALL S/S     EPR             WATT AV PWR LD   *
C *        PLMIN        I         ALL S/S     EPR             WATT MIN PWR LD  *
C *        PLR          INT       EPR         EPR             WATTTOT PWR LRE*
C *        PLRD         0         EPR         THERMAL         WATTPWR DISP LR*
C *        PS           INT       EPR         EPR,EPS         WATTEOL SOL OUT*
C *        RFD          INT       EPS         EPS                  TEMP DEG FC*
C *        S            INT       EP          EP          USED IN CALC OF TE   *
C *        SOL          INT       EPS         EPS         1353  W/M2AV SOL INT *

C *        TE           INT       EPS         EPR                  ECPS TIME   *
C *        TEDTS        INT       EPS         EPS                  DARK/LITE   *
C *        VB           INT       EPS         EPS             FT**3UNIT BATVOL*
C *        VBM          INT       EPR         EPS             VDCMIN BAT VLT*
C *        VBT          INT       EPS         EPS             FT**3TOT BAT VOL*
C *        VC           INT       EPS         EPS         1.1     VDCMIN CELL U  *
C *        VCELL        INT       DB          MAIN                 M3VOL CELL  *
C *        VDB          INT       EPR         EPR             VDCAVE ALL VOL*

C *        VOL          0         MAIN                        FT**3 EP VOL     *
C *        WATE         INT,0     EPS         YESIZE          KG ARRAY WT      *
C *        WB           INT       EPS         EPS               KGUNIT BAT WT*
C *        WBT          INT       EPS         EPS               KGTOT BAT WT  *
C *        WCELL        INT       DB          EPS               LB CELL WGT   *
C *        WT           0         MAIN                          LBS EP WT     *
C *                                                                           *
C ***************************************************************************

      COMMON /USERI/    APOGEE,     COMRAT,     DIAMAX,  EEOWT(9),      EPME,
                       EOM1WT,     EOM1XL,     EOM1YL,    EOM1ZL,    EOM2WT,
                       EOM2XL,     EOM2YL,     EOM2ZL,        FE,    IAGNCY,
           IDEBUG,     ISATOR,     MB12SH,     OPTEMP,    ORBINC,    PERIGE,
            MICRO,      RELME,    SPEC(6),      SPEC1,         T,    XCGSA1,
                         XMER,       XMEU

      COMMON /BTWN/      ACSSN,      ACSWP,        ALT,      AREA,    BATCAP,
                   BITRAT(2),      CLIFE,     CONVWT,         D,        DT,
                           DX,         DY,         DZ,     EOBLG,    EOBSID,
                           FC,         FF,     HARNWT,       HPT,    HTPIPE,
                         HTPT,     HTRPRB,     HTRPWR,                IBTLOC,
                        LMBDD,         NC,     OMEGS,     PASSTR,        PJ,
                           PL,      PLMIN,     POCNWT,      RADA,     RADAB,
                          RAT,         RJ,     SABOLG,     SATLG,    SATTWT,

                        SATWT,     SATXCG,     SATYCG,    SATZCG,     SA1XL,
                        SA1YL,      SA1ZL,       SIDE,     SYSLB,    THCMWT,
                    THRUST(2),         TI,      TNKWT,     TPRIM,        VB,
                         VCHP,        VOL,       WATE,        WB,       WBT,
                           WT,         XJ,          N,        YJ,        ZJ
```

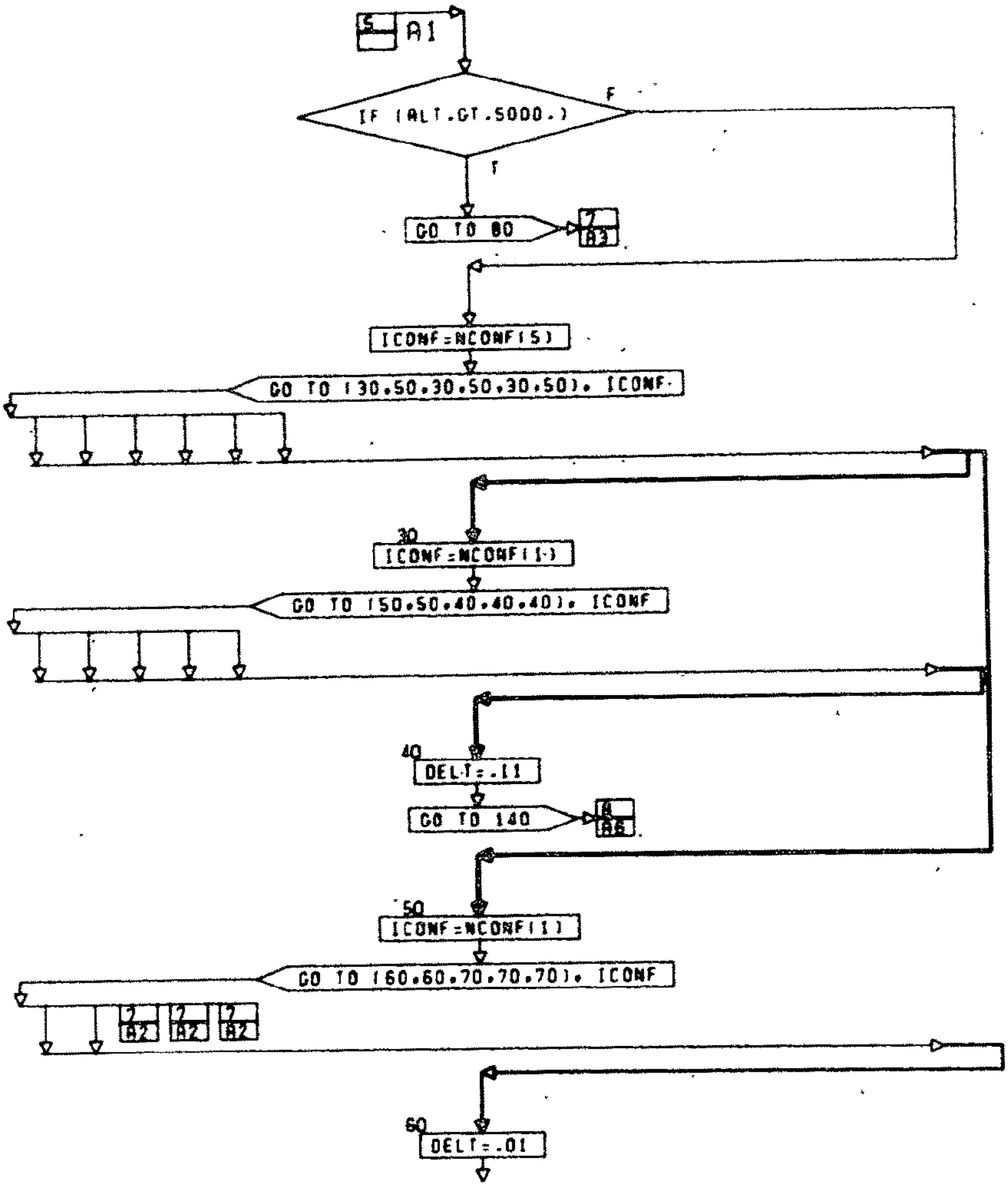
CONT. ON PG 4


COMMON /DBCOM/DATAB(55,100),IDB(30)
COMMON/PRTCOM/ ACCRCY, AM, AN, BF, BS,
CDPI(7,2), CISTAR, CTOT, DDTE, DE,
DRIWT, EOBSTR, FEEINV, FEEOPS, FEER,
GSE, IREL, ITRUNC, MMDOLD,NAME(3,60),
OPS, PAYINV, PAYOUL, PAYR, PE,
PMP, PMR, POWER(6), PU, PWR(60),
OCP, OCR, ROLD(60), SABMWT, SATADP,
SATINV, SATR, SEIP, SEIR, SKTAU(6),
SSREL(6), SUBE(7), SUBT(7), SUBUE(7), SUBUP(7),
TA, TAU(6,6), TB, TC, TE,
TF, TOOLR, TOOLU, TOTOPS, TRUNC,
TS, TTT,VOLUME(6), VOL(60),WEIGHT(6),
XLTOT, XMEH, XMEINV, XMEL, XMEVL,
XMEW, XMEWT, XVEST
DIMENSION NCONF(10), IPIC(5), ICHOSE(5), NCHOSE(5)
REAL MU,N,ICH,LMBDD,LMBDC,LMBDP,K1,K2
DATA DELF/.03/,DELI/.02/,DELM/.01/,ETAI/.105/,ETAR/1.0/,K1/1.02/,K
2/1.4/,LMBDP/.9/,SOL/1353./,VC/1.1/,PIE/3.1415926/
,CHMINT/2.0/
WTIN = WT
PL=PL+EPME
C **
C ** INITIALIZATION **
IF (ITER.NE.0)
F
T
GO TO 140
A
A6
LMBDD=0.50
C MEAN RADIUS OF EARTH IN FEET
HE = 20.92E6
MU=1.407645E16
HP = 6076. * PERIGE
A=HP+HE

CONT. ON PG 5

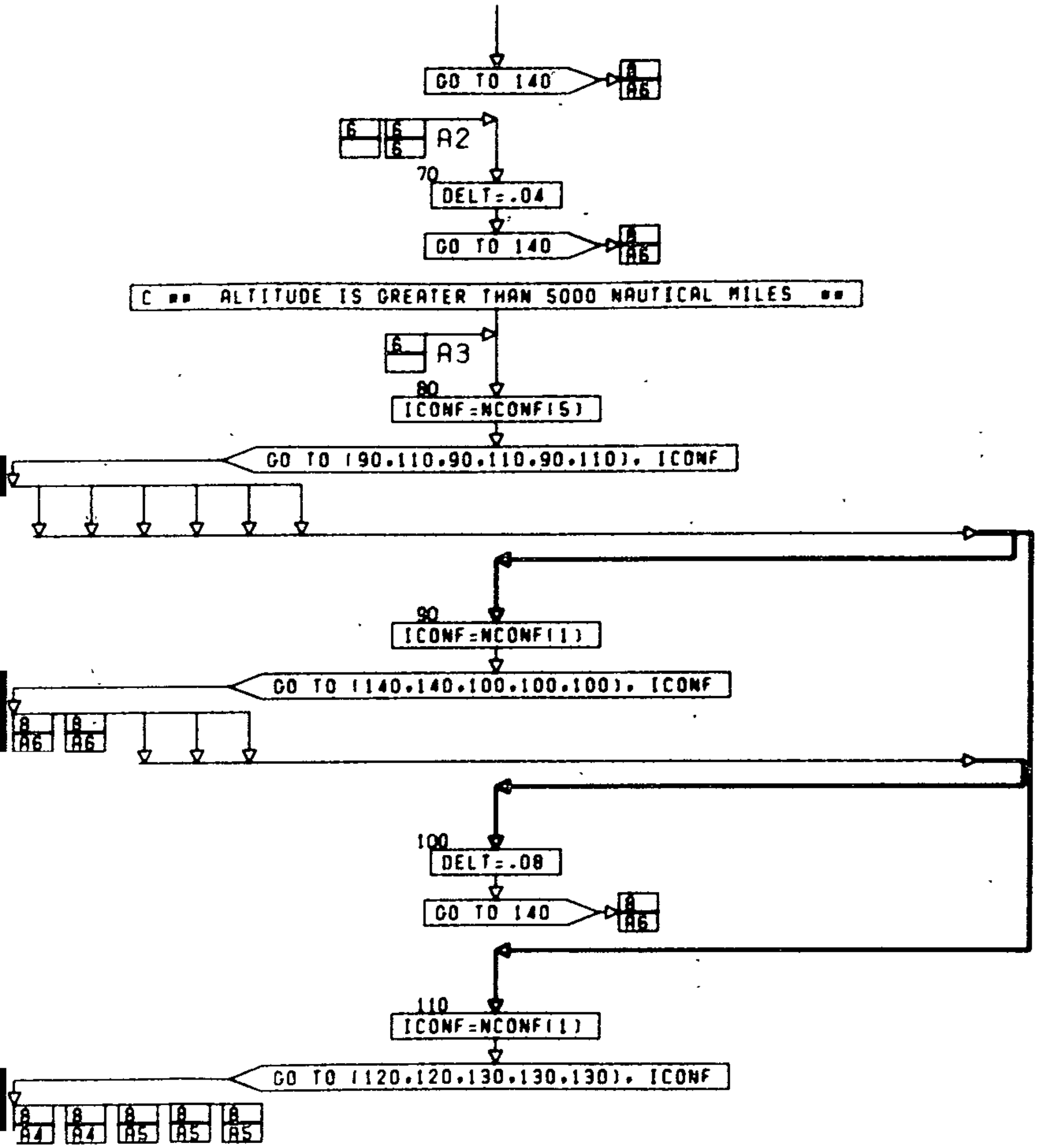

A32=A**1.5
HEDA=HE/A
S = 1.02 * ASIN(HEDA)
N=SQRT(MU)/A32
TEDTS=S/(PIE-S)
TE=2.*S/N
RFD=.01*OPTEMP+1.0
DO 10 I=1,5
10
ICHOSE(I)=0
IERR=0
C * LMBOD MUST GO TO REL
NB=2
DO 20 I=1,5
20
NCHOSE(I)=0
NLR=2
WATE=0.0
AREA=0.0
C ** SET UP DELTA-R AND DELTA-T (RADIATION DEGRADATION AND
C TEMPERATURE CORRECTION FACTORS)
DELR=.05
IF (ALT.GT.400.)
F
T
6
A1
DELR=.3

CONT. ON PG 6

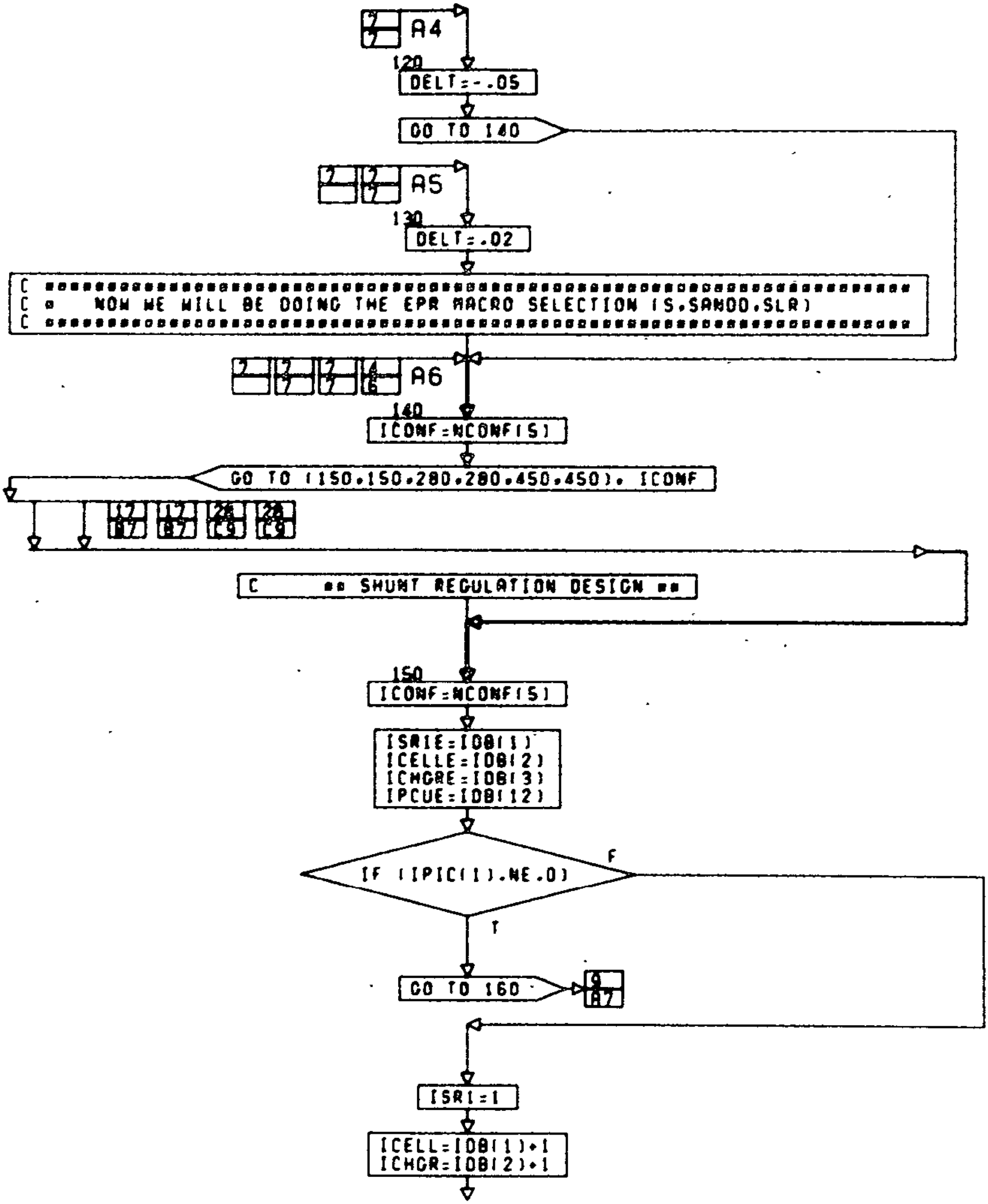


5
A1
IF (ALT.GT.5000.)
F
T
GO TO 80
7
A3
ICONF=NCONF(5)
GO TO (30,50,30,50,30,50), ICONF
30
ICONF=NCONF(1)
GO TO (50,50,40,40,40), ICONF
40
DELT=.11
GO TO 140
8
A6
50
ICONF=NCONF(1)
GO TO (60,60,70,70,70), ICONF
7
A2
7
A2
7
A2
60
DELT=.01

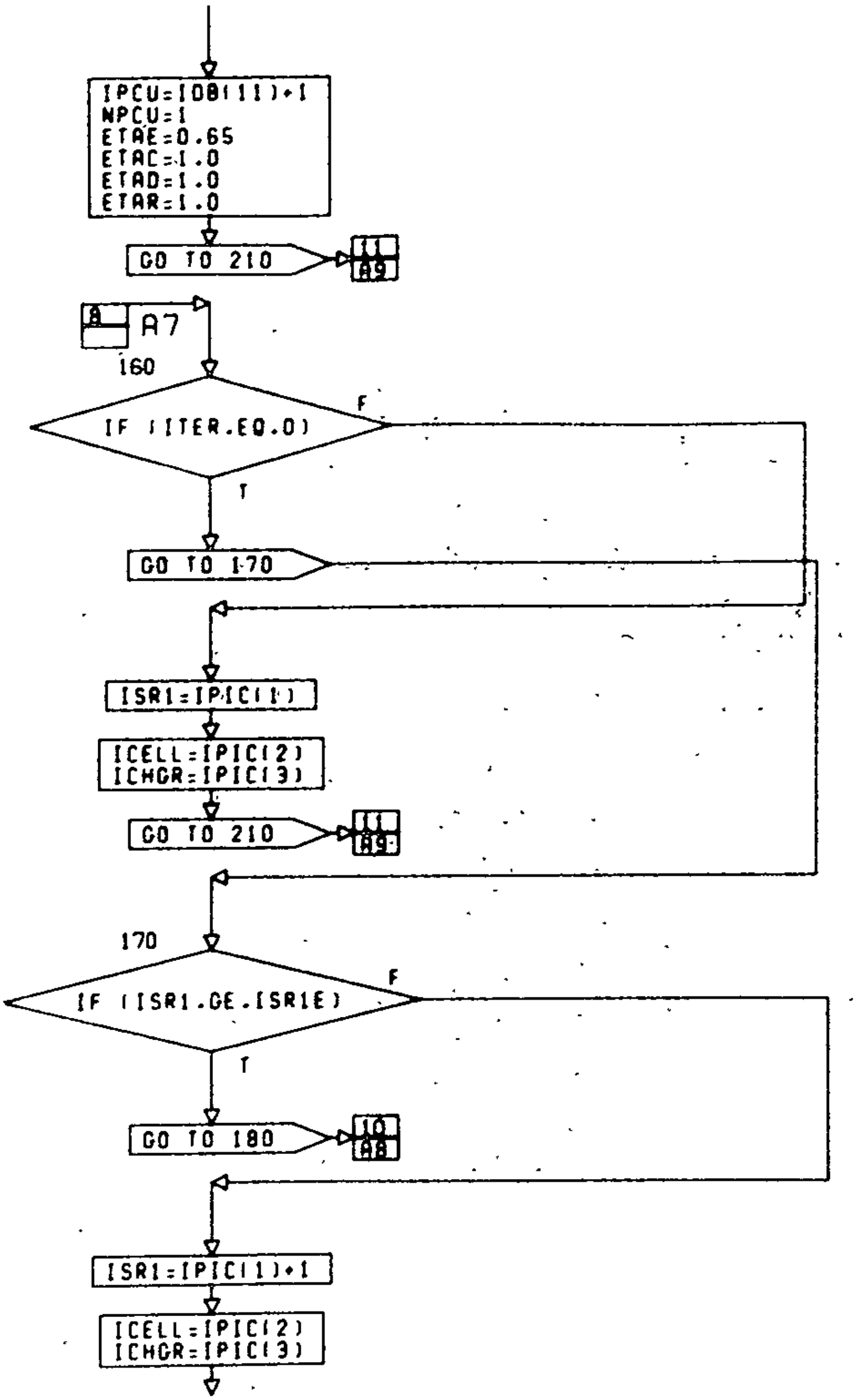
CONT. ON PG 7


GO TO 140
A2
70
DELT=.04
GO TO 140
C ** ALTITUDE IS GREATER THAN 5000 NAUTICAL MILES **
A3
80
ICONF=NCONF(5)
GO TO (90,110,90,110,90,110), ICONF
90
ICONF=NCONF(1)
GO TO (140,140,100,100,100), ICONF
100
DELT=.08
GO TO 140
110
ICONF=NCONF(1)
GO TO (120,120,130,130,130), ICONF

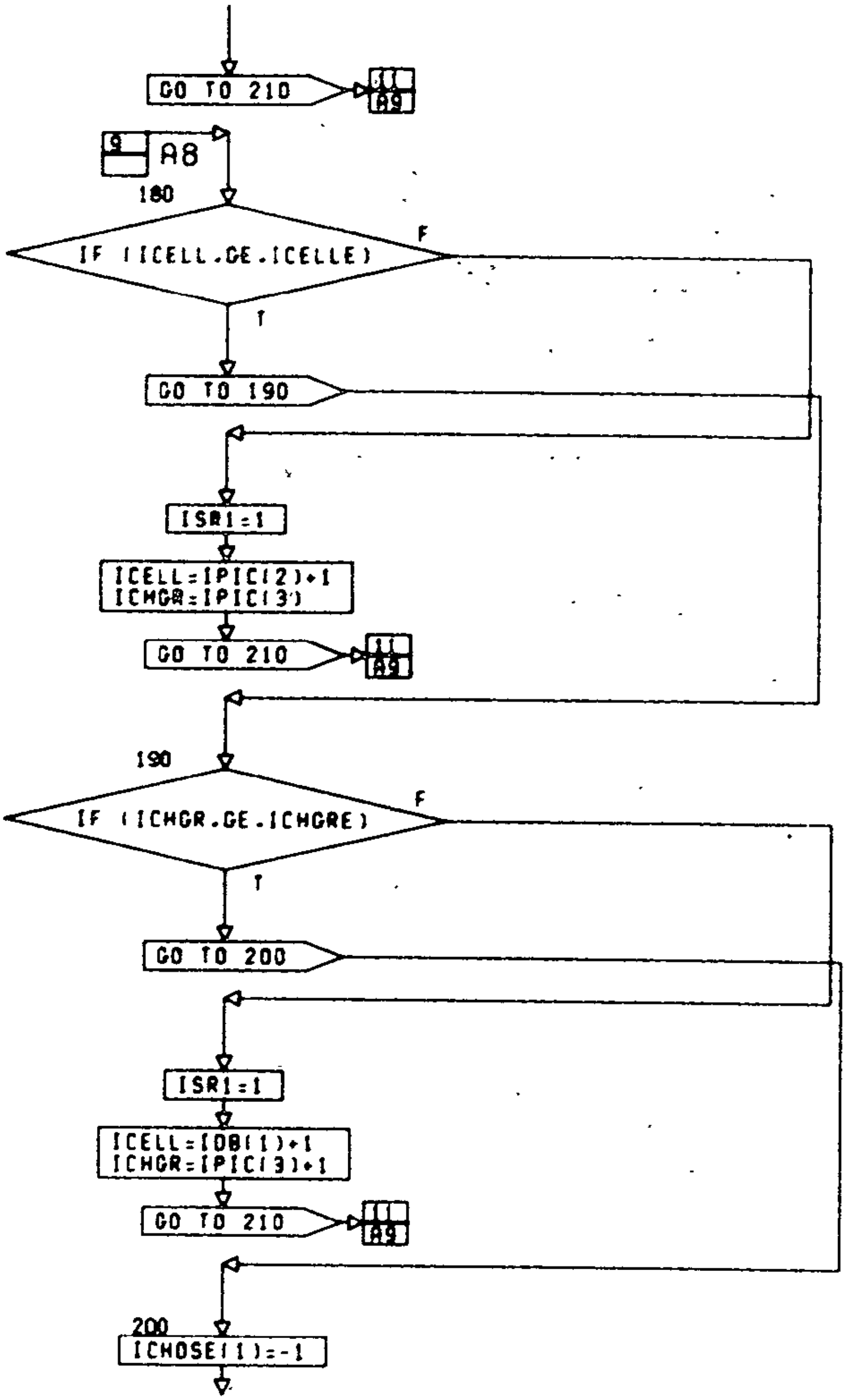
CONT. ON PG 8


A4
120
DELT=-.05
GO TO 140
A5
130
DELT=.02
C **
C *   NOW WE WILL BE DOING THE EPR MACRO SELECTION (S,SANDD,SLR)
C **
A6
140
ICONF=NCONF(5)
GO TO (150,150,280,280,450,450), ICONF
17 B7
17 B7
28 C9
28 C9
C ** SHUNT REGULATION DESIGN **
150
ICONF=NCONF(5)
ISRIE=IDB(1)
ICELLE=IDB(2)
ICHGRE=IDB(3)
IPCUE=IDB(12)
IF (IPIC(1).NE.0)
F
T
GO TO 160
9 A7
ISR1=1
ICELL=IDB(1)+1
ICHGR=IDB(2)+1

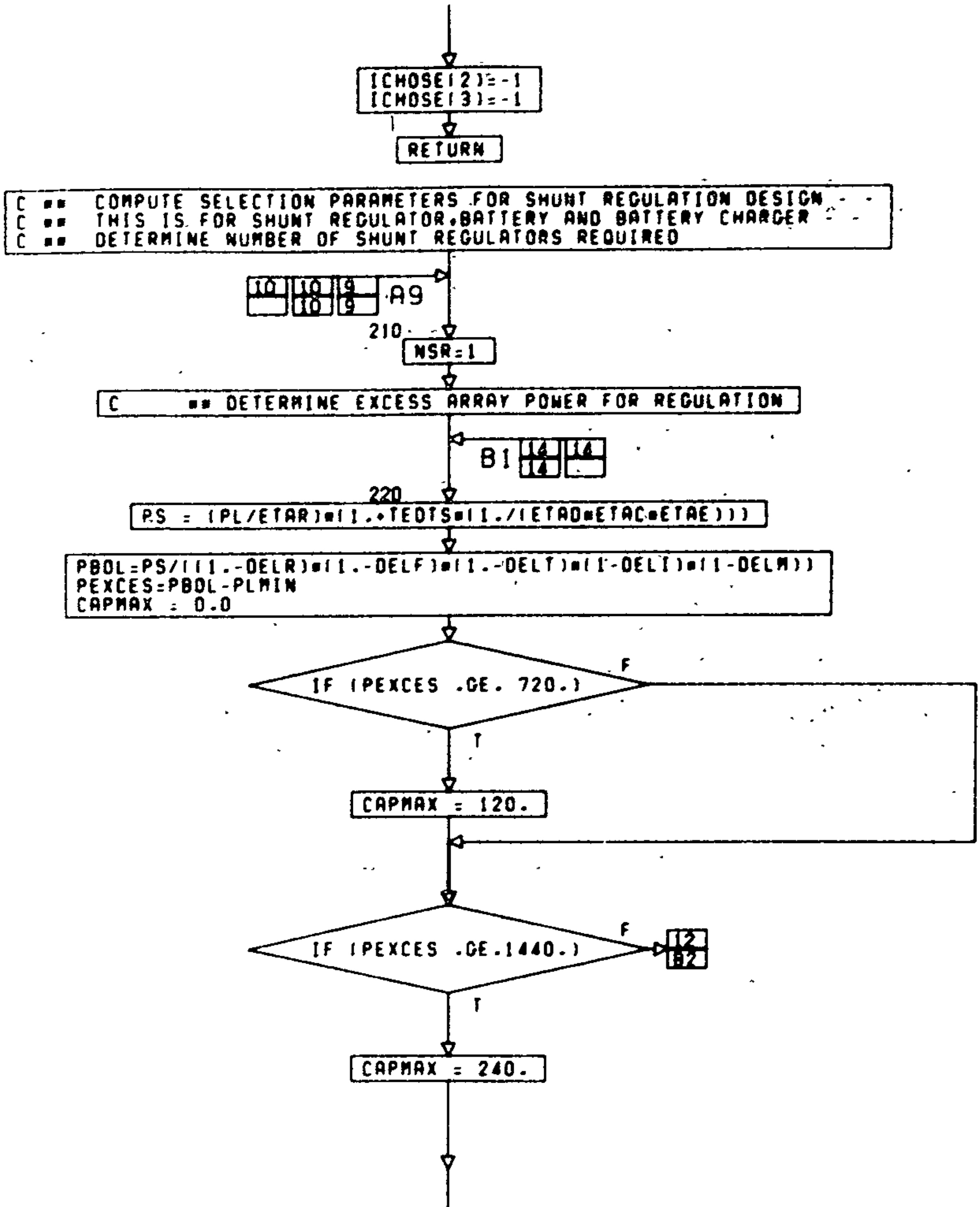
CONT. ON PG 9


IPCU=IDB(11)+1
NPCU=1
ETAE=0.65
ETAC=1.0
ETAD=1.0
ETAR=1.0
GO TO 210
11
A9
A
A7
160
IF (ITER.EQ.0)
F
T
GO TO 170
ISR1=IPIC(1)
ICELL=IPIC(2)
ICHGR=IPIC(3)
GO TO 210
11
A9
170
IF (ISR1.GE.ISR1E)
F
T
GO TO 180
10
A8
ISR1=IPIC(1)+1
ICELL=IPIC(2)
ICHGR=IPIC(3)

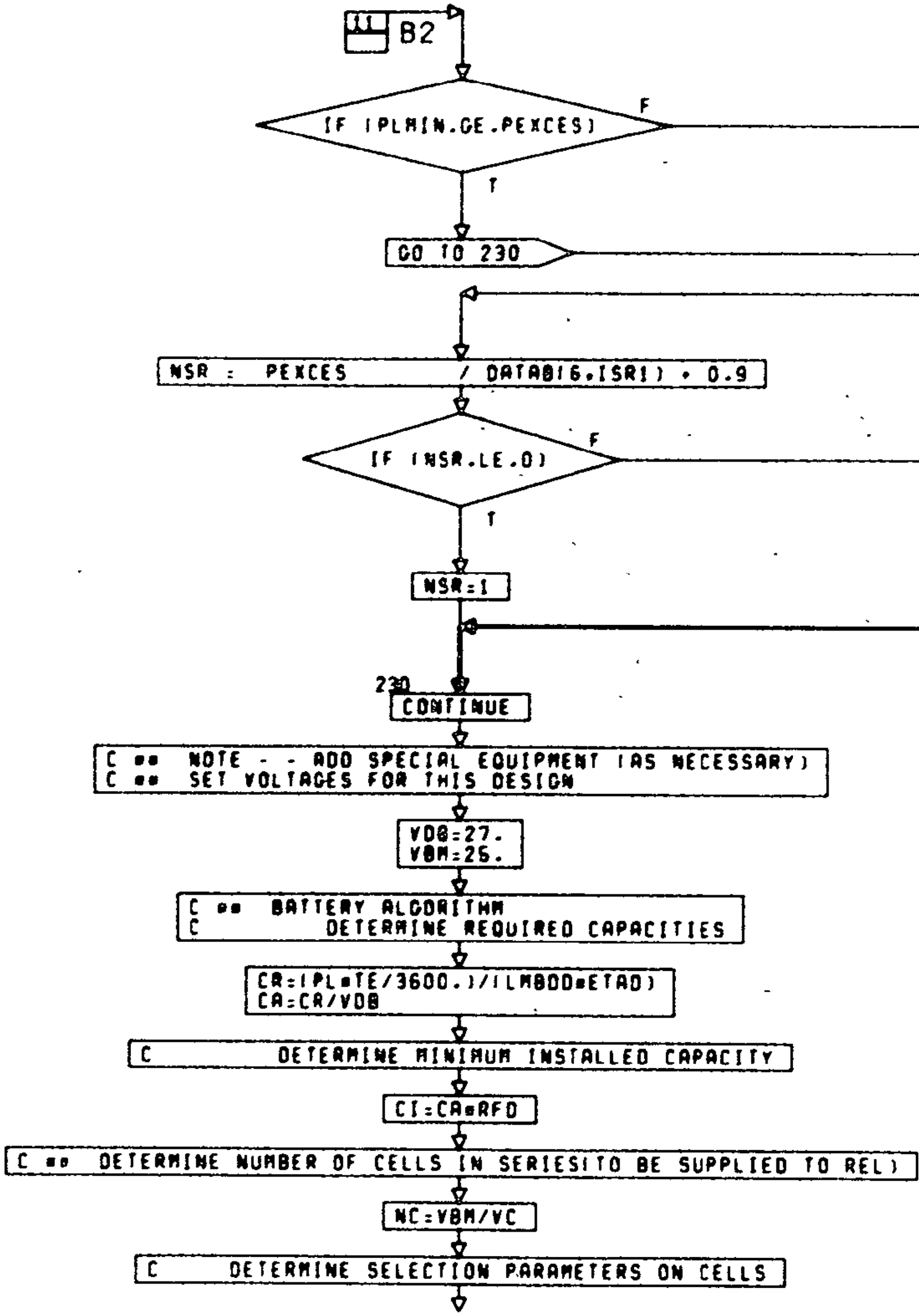
CONT. ON PG 10


GO TO 210
11
A9
9
A8
180
IF (ICELL.GE.ICELLE)
F
T
GO TO 190
ISR1=1
ICELL=IPIC(2)+1
ICHGR=IPIC(3)
GO TO 210
11
A9
190
IF (ICHGR.GE.ICHGRE)
F
T
GO TO 200
ISR1=1
ICELL=IDB(1)+1
ICHGR=IPIC(3)+1
GO TO 210
11
A9
200
ICHOSE(1)=-1

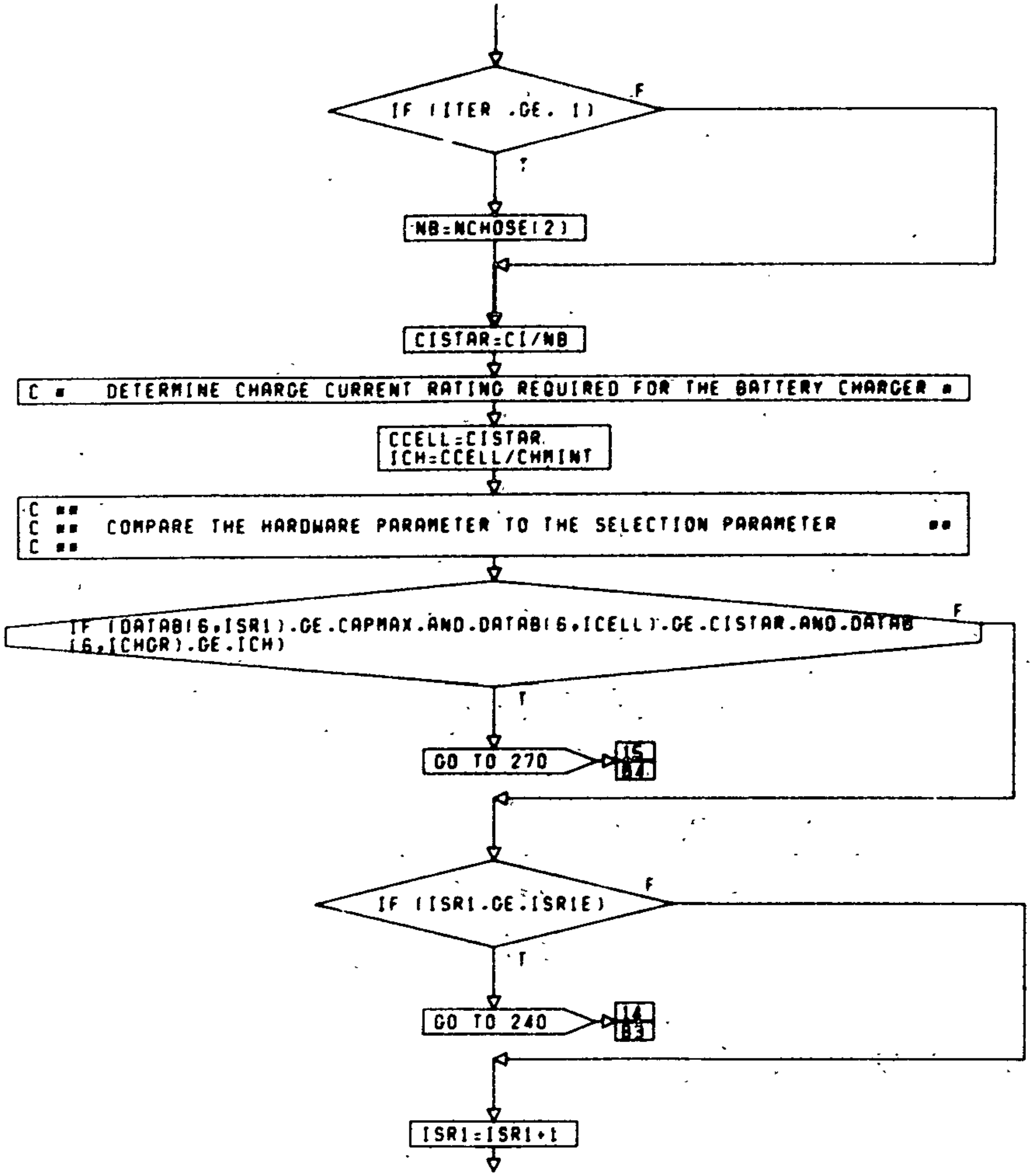
CONT. ON PG 11


ICHOSE(2)=-1
ICHOSE(3)=-1
RETURN
C ** COMPUTE SELECTION PARAMETERS FOR SHUNT REGULATION DESIGN
C ** THIS IS FOR SHUNT REGULATOR,BATTERY AND BATTERY CHARGER
C ** DETERMINE NUMBER OF SHUNT REGULATORS REQUIRED
10
10
10
9
9
A9
210
NSR=1
C ** DETERMINE EXCESS ARRAY POWER FOR REGULATION
B1
14
14
14
220
PS = (PL/ETAR)*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))
PBOL=PS/((1.-DELR)*(1.-DELF)*(1.-DELT)*(1-DELI)*(1-DELM))
PEXCES=PBOL-PLMIN
CAPMAX = 0.0
IF (PEXCES .GE. 720.)
F
T
CAPMAX = 120.
IF (PEXCES .GE.1440.)
F
12
B2
T
CAPMAX = 240.

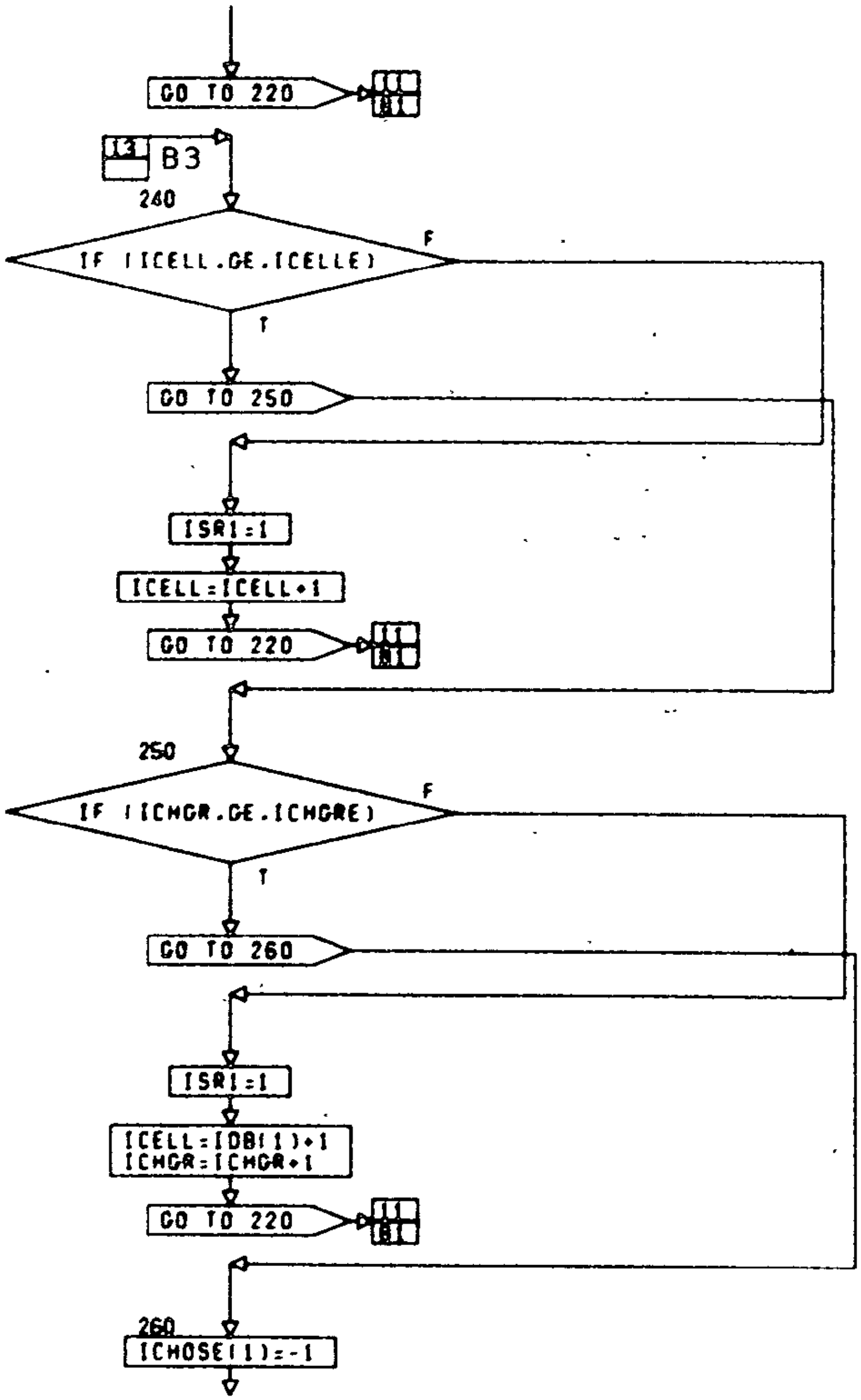
CONT. ON PG 12


B2
IF (PLMIN.GE.PEXCES)
F
T
GO TO 230
NSR = PEXCES / DATAB(6,ISR1) + 0.9
IF (NSR.LE.0)
F
T
NSR=1
230
CONTINUE
C ** NOTE - - ADD SPECIAL EQUIPMENT (AS NECESSARY)
C ** SET VOLTAGES FOR THIS DESIGN
VDB=27.
VBM=25.
C ** BATTERY ALGORITHM
C DETERMINE REQUIRED CAPACITIES
CR=(PL*TE/3600.)/(LMBDD*ETAD)
CA=CR/VDB
C DETERMINE MINIMUM INSTALLED CAPACITY
CI=CA*RFD
C ** DETERMINE NUMBER OF CELLS IN SERIES(TO BE SUPPLIED TO REL)
NC=VBM/VC
C DETERMINE SELECTION PARAMETERS ON CELLS

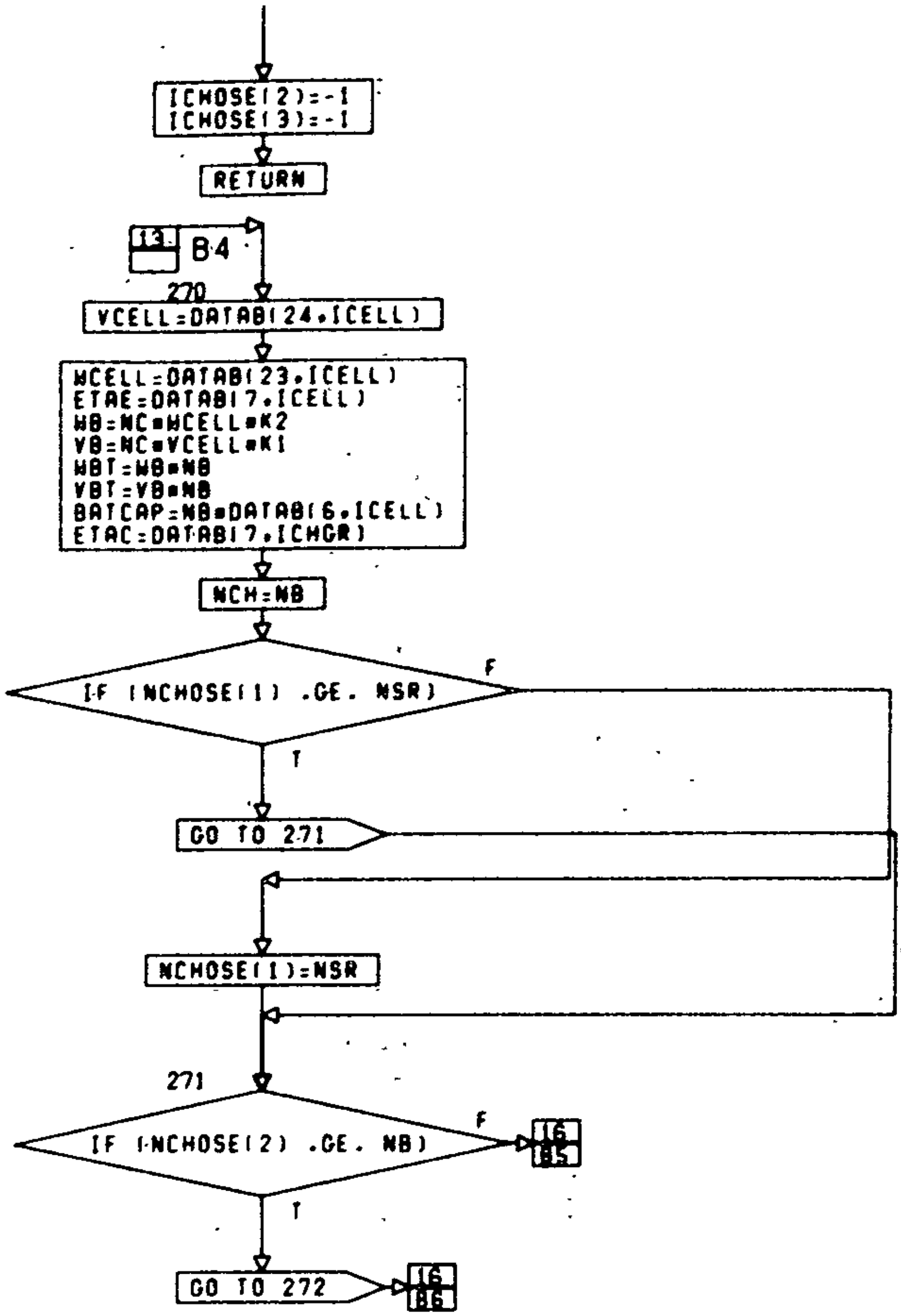
CONT. ON PG 13


IF (ITER .GE. 1)
F
T
NB=NCHOSE(2)
CISTAR=CI/NB
C * DETERMINE CHARGE CURRENT RATING REQUIRED FOR THE BATTERY CHARGER *
CCELL=CISTAR
ICH=CCELL/CHMINT
C **
C ** COMPARE THE HARDWARE PARAMETER TO THE SELECTION PARAMETER **
C **
IF (DATAB(6,ISR1).GE.CAPMAX.AND.DATAB(6,ICELL).GE.CISTAR.AND.DATAB (6,ICHGR).GE.ICH)
F
T
GO TO 270
15
B4
IF (ISR1.GE.ISR1E)
F
T
GO TO 240
14
B3
ISR1=ISR1+1

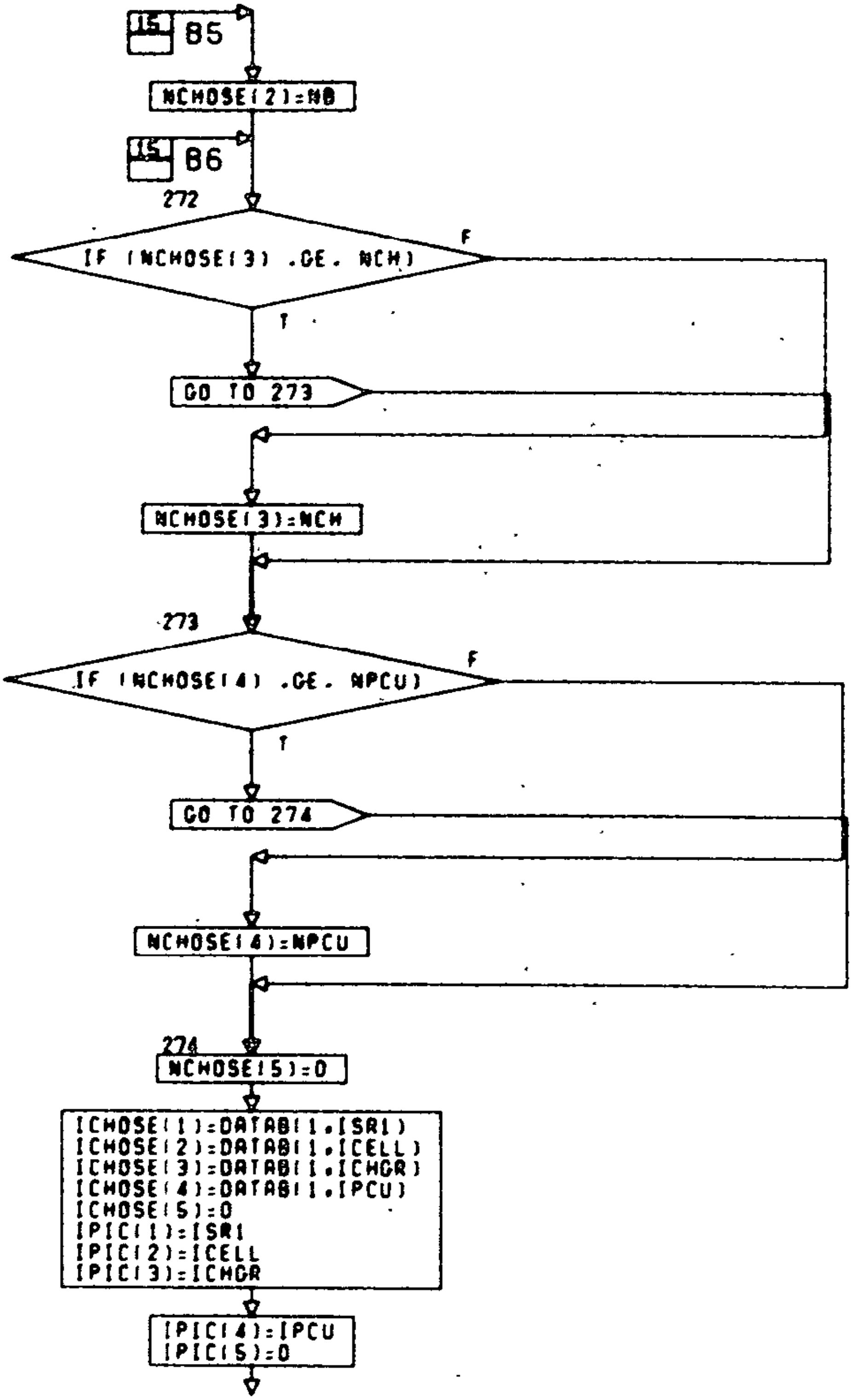
CONT. ON PG 14


GO TO 220
I1
B1
I3
B3
240
IF (ICELL.GE.ICELLE)
F
T
GO TO 250
ISR1=1
ICELL=ICELL+1
GO TO 220
I1
B1
250
IF (ICHGR.GE.ICHGRE)
F
T
GO TO 260
ISR1=1
ICELL=IDB(1)+1
ICHGR=ICHGR+1
GO TO 220
I1
B1
260
ICHOSE(1)=-1

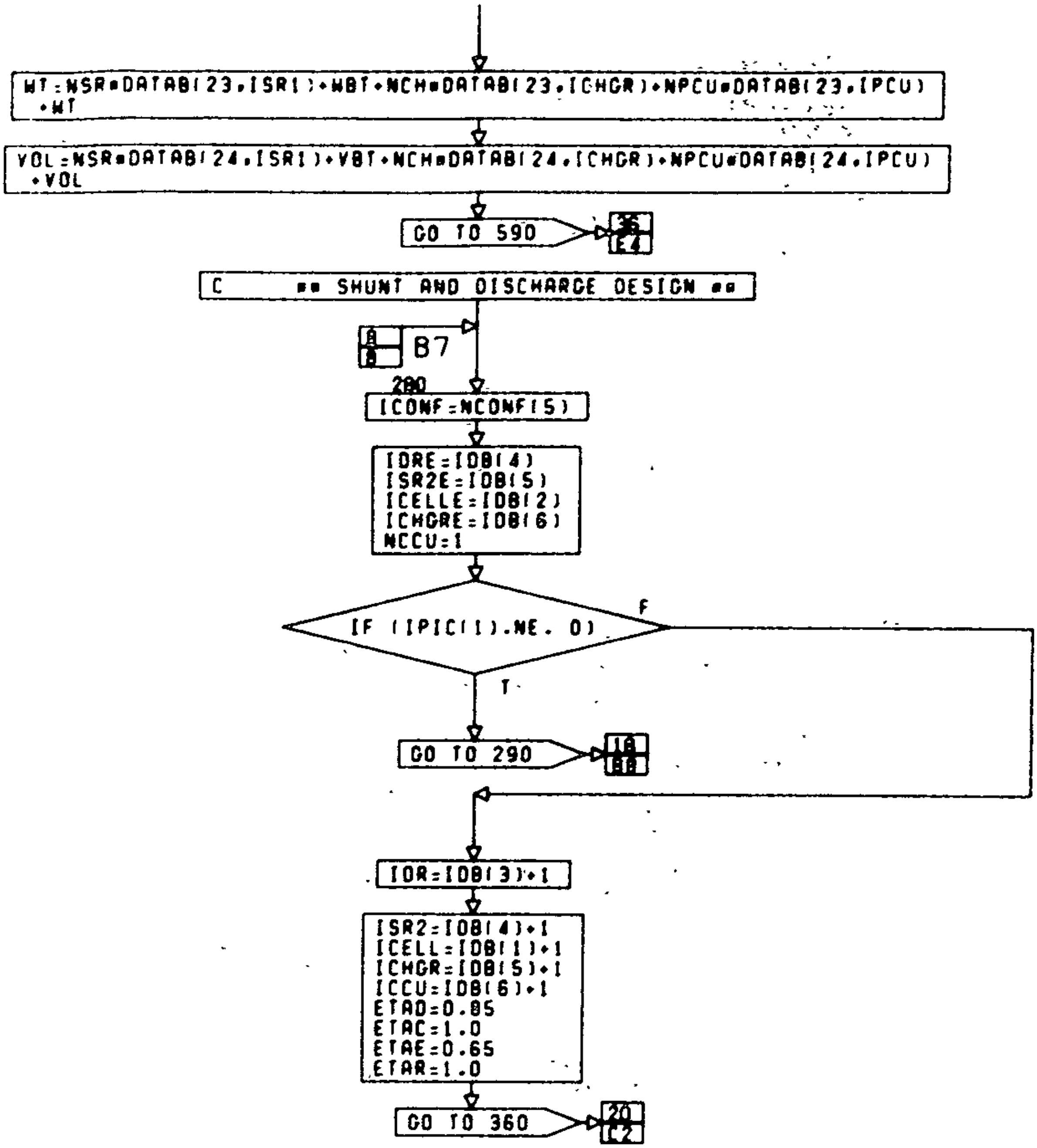
CONT. ON PG 15


ICHOSE(2)=-1
ICHOSE(3)=-1
RETURN
13
B4
270
VCELL=DATAB(24,ICELL)
WCELL=DATAB(23,ICELL)
ETAE=DATAB(7,ICELL)
WB=NC*WCELL*K2
VB=NC*VCELL*K1
WBT=WB*NB
VBT=VB*NB
BATCAP=NB*DATAB(6,ICELL)
ETAC=DATAB(7,ICHGR)
NCH=NB
IF (NCHOSE(1) .GE. NSR)
F
T
GO TO 271
NCHOSE(1)=NSR
271
IF (NCHOSE(2) .GE. NB)
F
16
B5
T
GO TO 272
16
B6

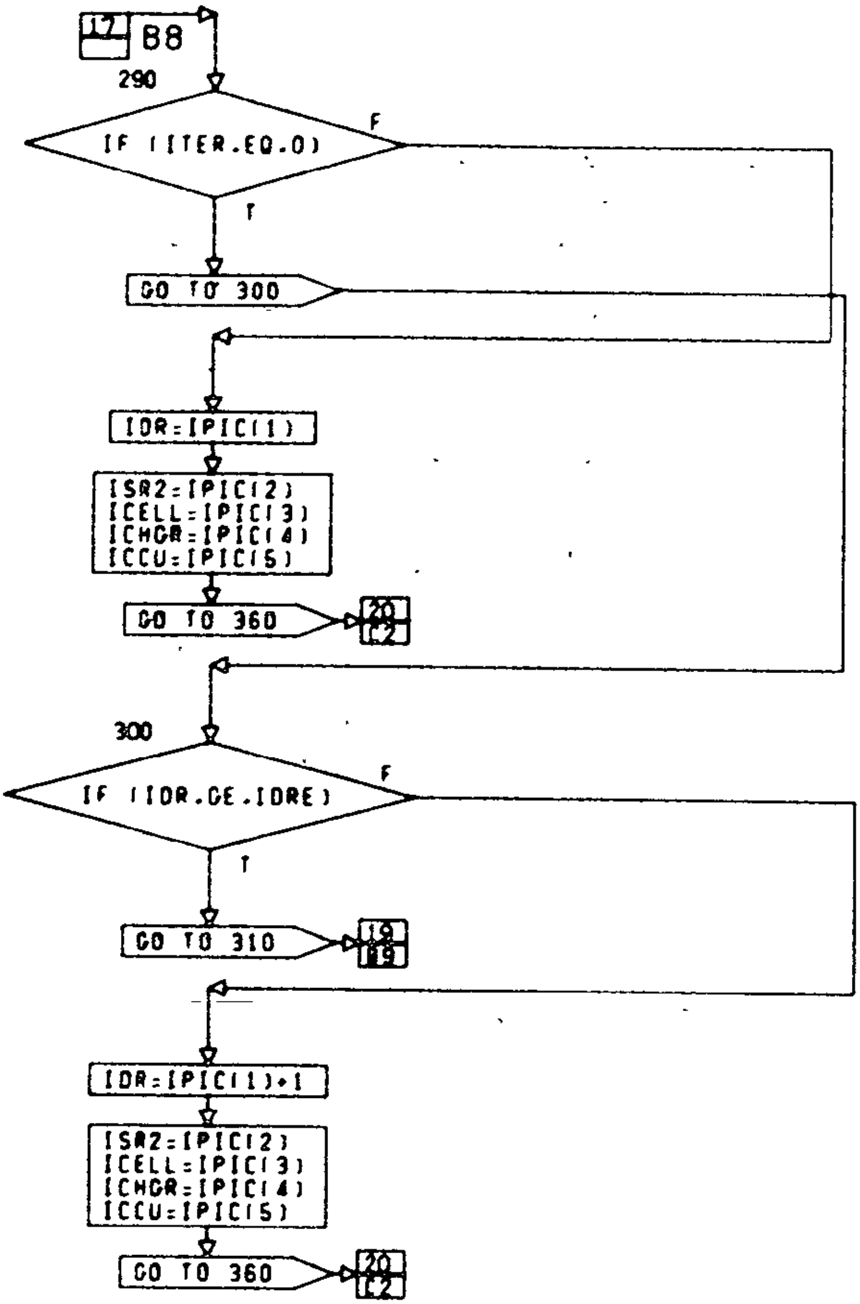
CONT. ON PG 16


15
B5
NCHOSE(2)=NB
15
B6
272
IF (NCHOSE(3) .GE. NCH)
F
T
GO TO 273
NCHOSE(3)=NCH
273
IF (NCHOSE(4) .GE. NPCU)
F
T
GO TO 274
NCHOSE(4)=NPCU
274
NCHOSE(5)=0
ICHOSE(1)=DATAB(1,ISR1)
ICHOSE(2)=DATAB(1,ICELL)
ICHOSE(3)=DATAB(1,ICHGR)
ICHOSE(4)=DATAB(1,IPCU)
ICHOSE(5)=0
IPIC(1)=ISR1
IPIC(2)=ICELL
IPIC(3)=ICHGR
IPIC(4)=IPCU
IPIC(5)=0

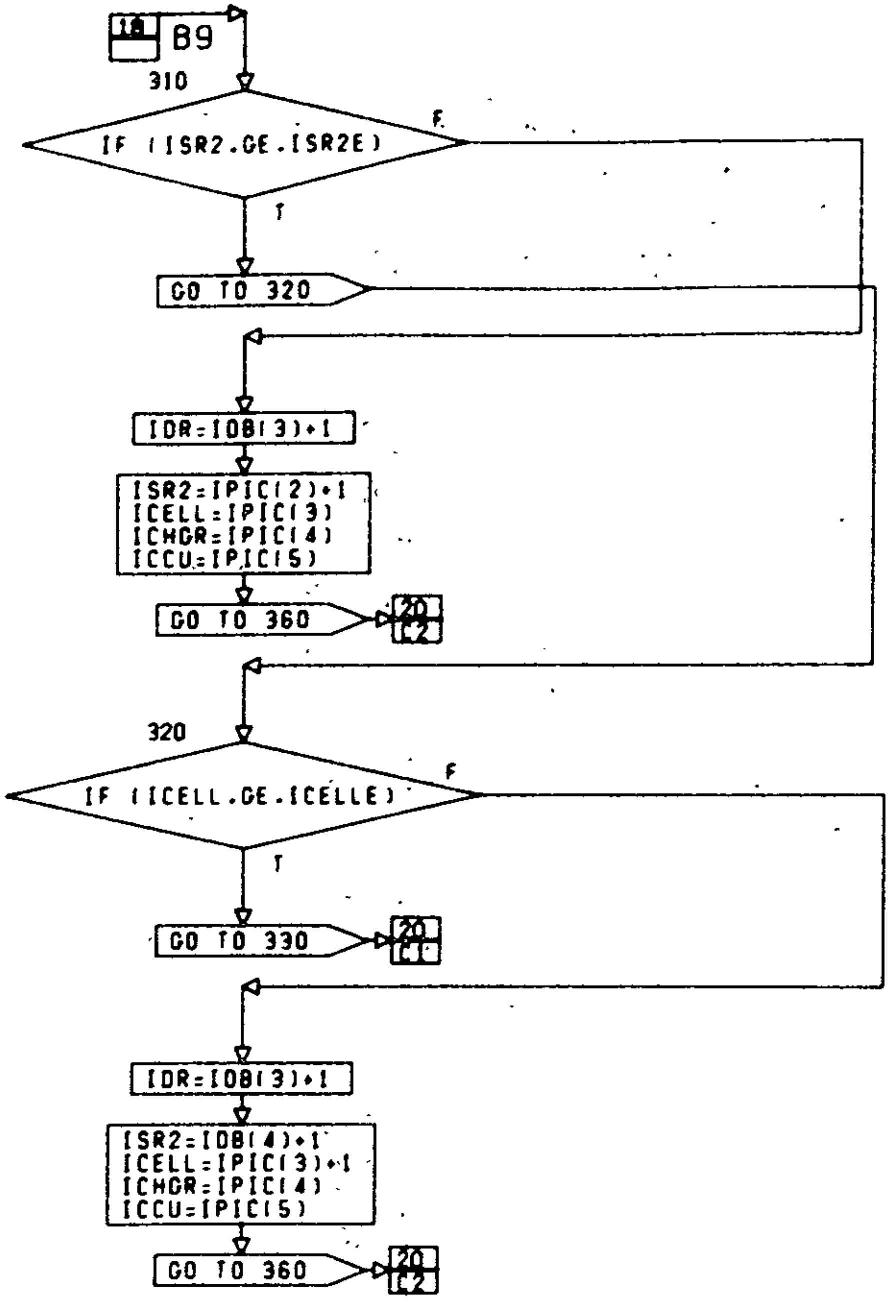
CONT. ON PG 17


WT=NSR*DATAB(23,ISR1)+WBT+NCH*DATAB(23,ICHGR)+NPCU*DATAB(23,IPCU)
+WT
VOL=NSR*DATAB(24,ISR1)+VBT+NCH*DATAB(24,ICHGR)+NPCU*DATAB(24,IPCU)
+VOL
GO TO 590
36
E4
C ** SHUNT AND DISCHARGE DESIGN **
A
B
B7
280
ICONF=NCONF(5)
IDRE=IDB(4)
ISR2E=IDB(5)
ICELLE=IDB(2)
ICHGRE=IDB(6)
NCCU=1
IF (IPIC(1).NE. 0)
F
T
GO TO 290
18
B8
IDR=IDB(3)+1
ISR2=IDB(4)+1
ICELL=IDB(1)+1
ICHGR=IDB(5)+1
ICCU=IDB(6)+1
ETAD=0.85
ETAC=1.0
ETAE=0.65
ETAR=1.0
GO TO 360
20
C2

CONT. ON PG 18

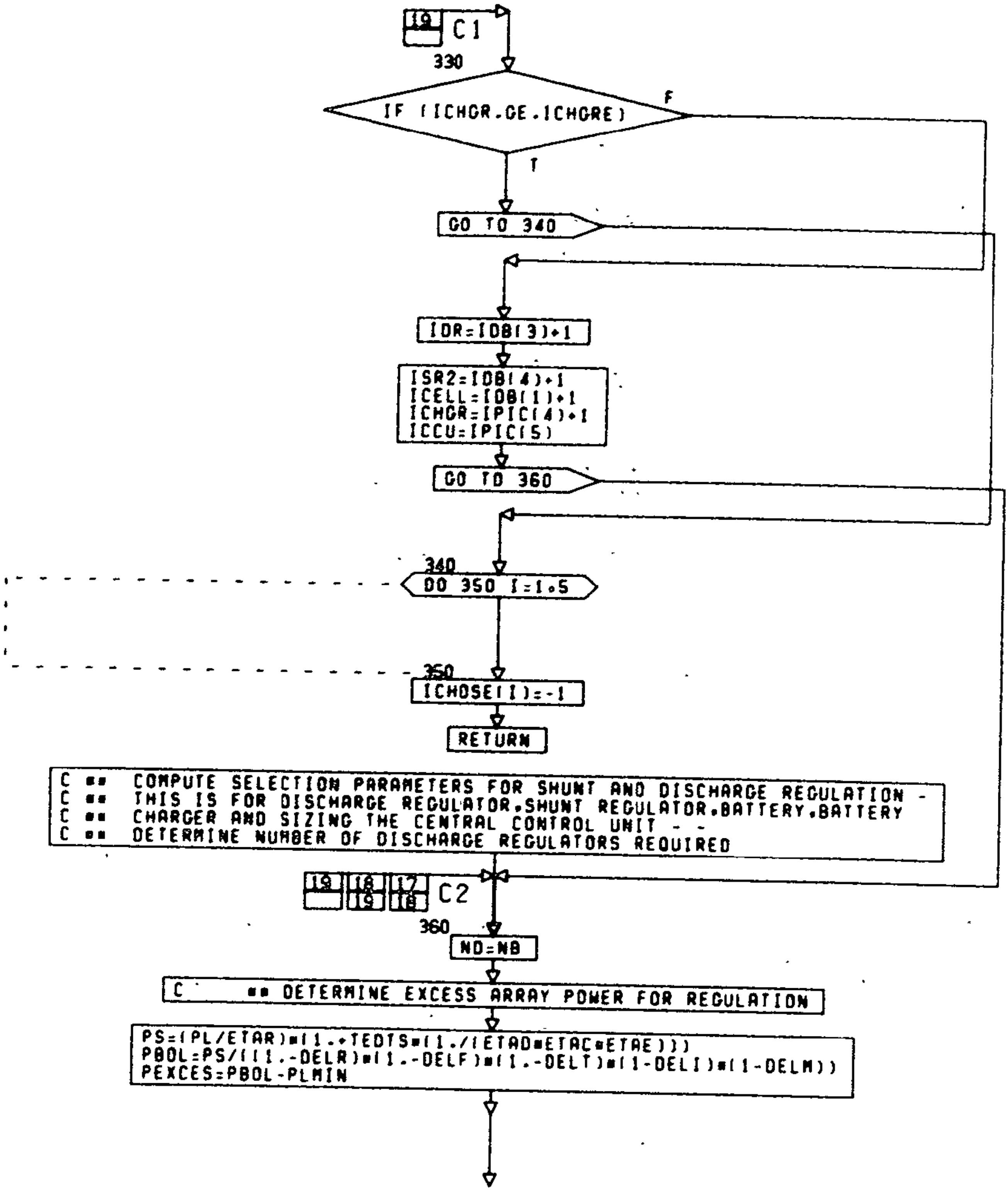

17
B8
290
IF (ITER.EQ.0)
F
T
GO TO 300
IDR=IPIC(1)
ISR2=IPIC(2)
ICELL=IPIC(3)
ICHGR=IPIC(4)
ICCU=IPIC(5)
GO TO 360
20
C2
300
IF (IDR.GE.IDRE)
F
T
GO TO 310
19
B9
IDR=IPIC(1)+1
ISR2=IPIC(2)
ICELL=IPIC(3)
ICHGR=IPIC(4)
ICCU=IPIC(5)
GO TO 360
20
C2

CONT. ON PG 19

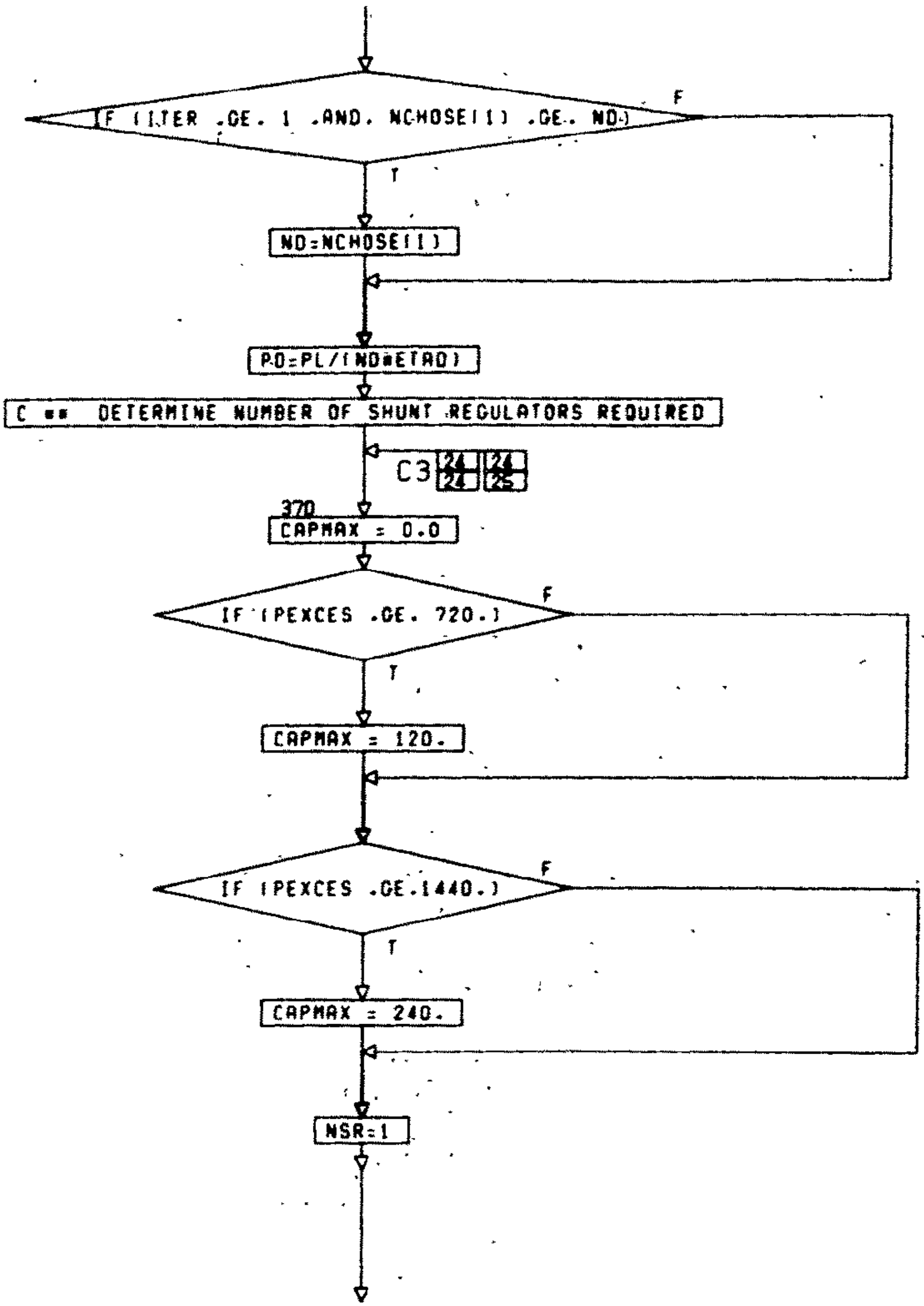


B9
310
IF (ISR2.GE.ISR2E)
F
T
GO TO 320
IDR=IDB(3)+1
ISR2=IPIC(2)+1
ICELL=IPIC(3)
ICHGR=IPIC(4)
ICCU=IPIC(5)
GO TO 360
20
C2
320
IF (ICELL.GE.ICELLE)
F
T
GO TO 330
20
C1
IDR=IDB(3)+1
ISR2=IDB(4)+1
ICELL=IPIC(3)+1
ICHGR=IPIC(4)
ICCU=IPIC(5)
GO TO 360
20
C2

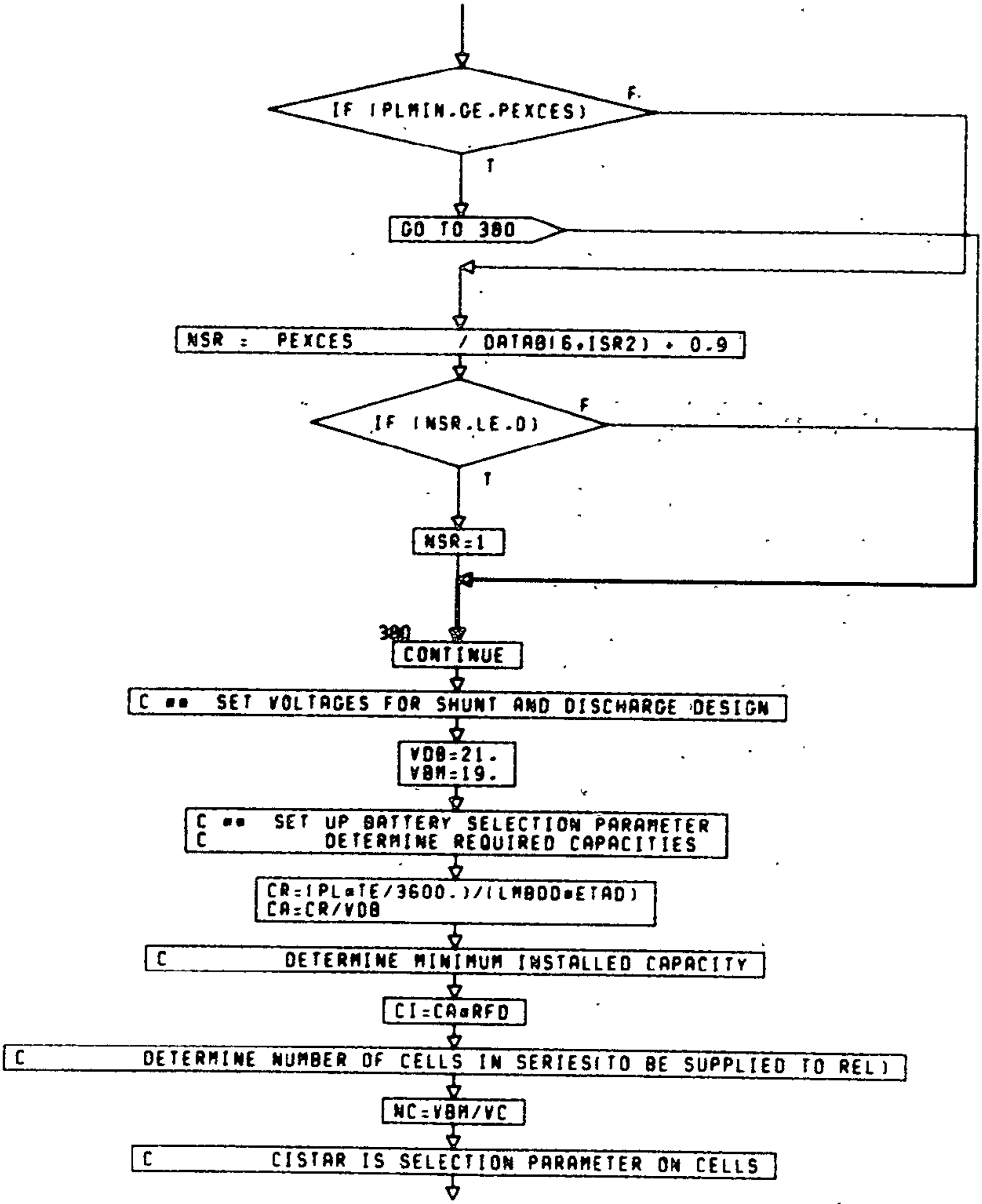
CONT. ON PG 20


19
C1
330
IF (ICHGR.GE.ICHGRE)
F
T
GO TO 340
IDR=IDB(3)+1
ISR2=IDB(4)+1
ICELL=IDB(1)+1
ICHGR=IPIC(4)+1
ICCU=IPIC(5)
GO TO 360
340
DO 350 I=1,5
350
ICHOSE(I)=-1
RETURN
C ** COMPUTE SELECTION PARAMETERS FOR SHUNT AND DISCHARGE REGULATION -
C ** THIS IS FOR DISCHARGE REGULATOR,SHUNT REGULATOR,BATTERY,BATTERY
C ** CHARGER AND SIZING THE CENTRAL CONTROL UNIT - -
C ** DETERMINE NUMBER OF DISCHARGE REGULATORS REQUIRED
19
18
19
17
18
C2
360
ND=NB
C ** DETERMINE EXCESS ARRAY POWER FOR REGULATION
PS=(PL/ETAR)*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))
PBOL=PS/((1.-DELR)*(1.-DELF)*(1.-DELT)*(1-DELI)*(1-DELM))
PEXCES=PBOL-PLMIN

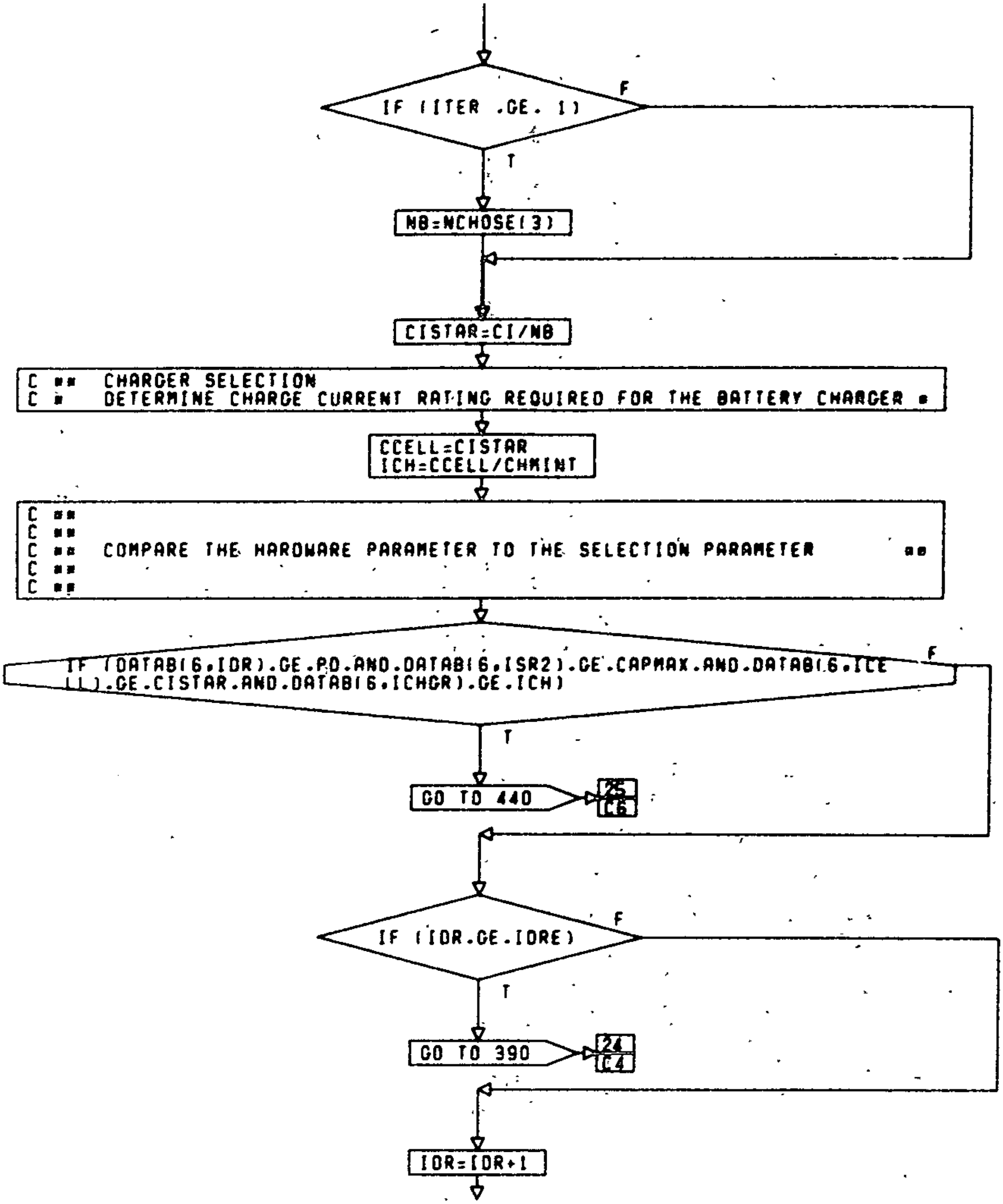
CONT. ON PG 21


IF (ITER .GE. 1 .AND. NCHOSE(1) .GE. ND)
F
T
ND=NCHOSE(1)
PD=PL/(ND*ETAD)
C ** DETERMINE NUMBER OF SHUNT REGULATORS REQUIRED
C3 24 24 24 25
370
CAPMAX = 0.0
IF (PEXCES .GE. 720.)
F
T
CAPMAX = 120.
IF (PEXCES .GE.1440.)
F
T
CAPMAX = 240.
NSR=1

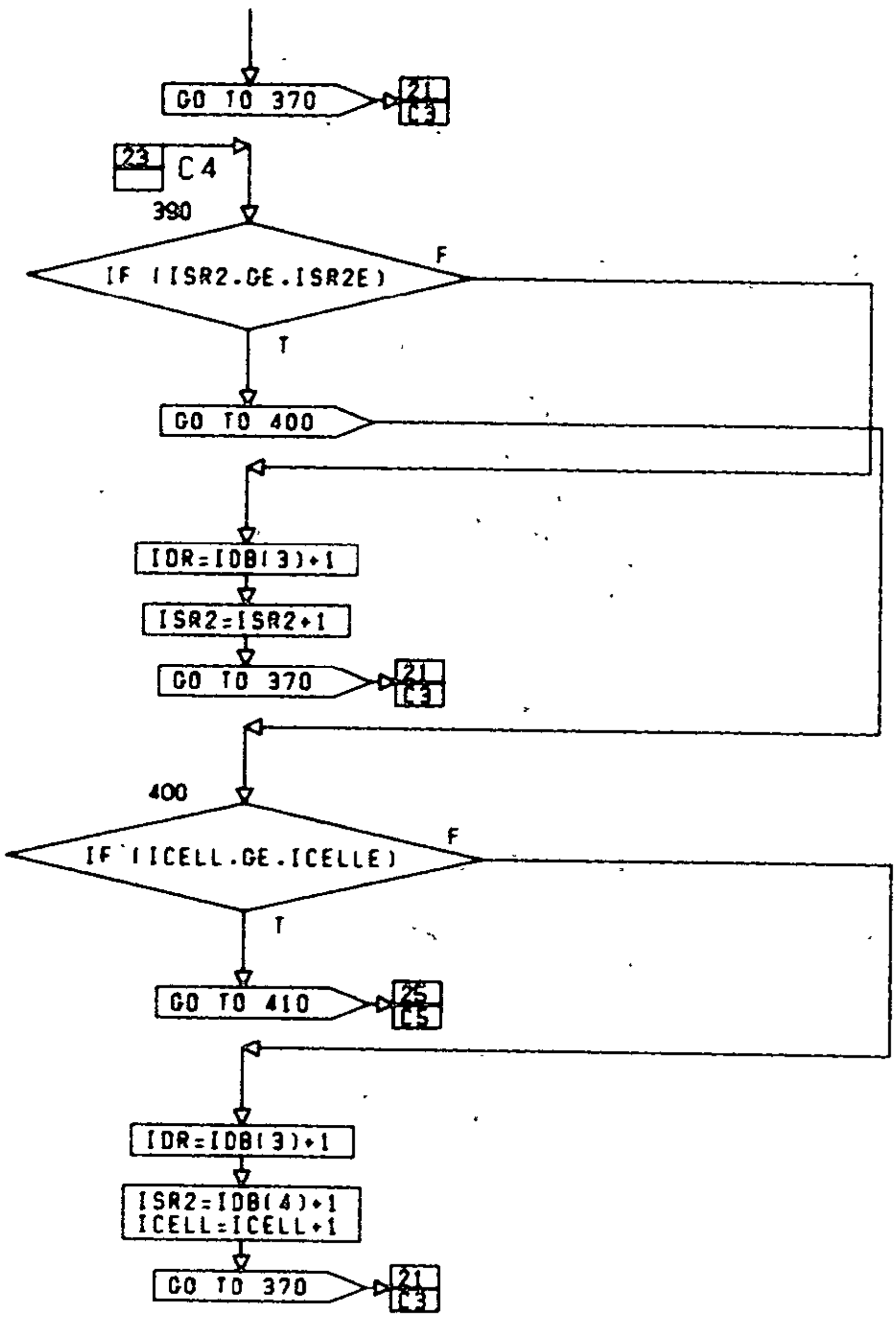
CONT. ON PG 22


IF (PLMIN.GE.PEXCES)
F.
T
GO TO 380
NSR = PEXCES / DATAB(6,ISR2) + 0.9
IF (NSR.LE.0)
F
T
NSR=1
380
CONTINUE
C ** SET VOLTAGES FOR SHUNT AND DISCHARGE DESIGN
VDB=21.
VBM=19.
C ** SET UP BATTERY SELECTION PARAMETER
C DETERMINE REQUIRED CAPACITIES
CR=(PL*TE/3600.)/(LMBDD*ETAD)
CA=CR/VDB
C DETERMINE MINIMUM INSTALLED CAPACITY
CI=CA*RFD
C DETERMINE NUMBER OF CELLS IN SERIES(TO BE SUPPLIED TO REL)
NC=VBM/VC
C CISTAR IS SELECTION PARAMETER ON CELLS

CONT. ON PG 23

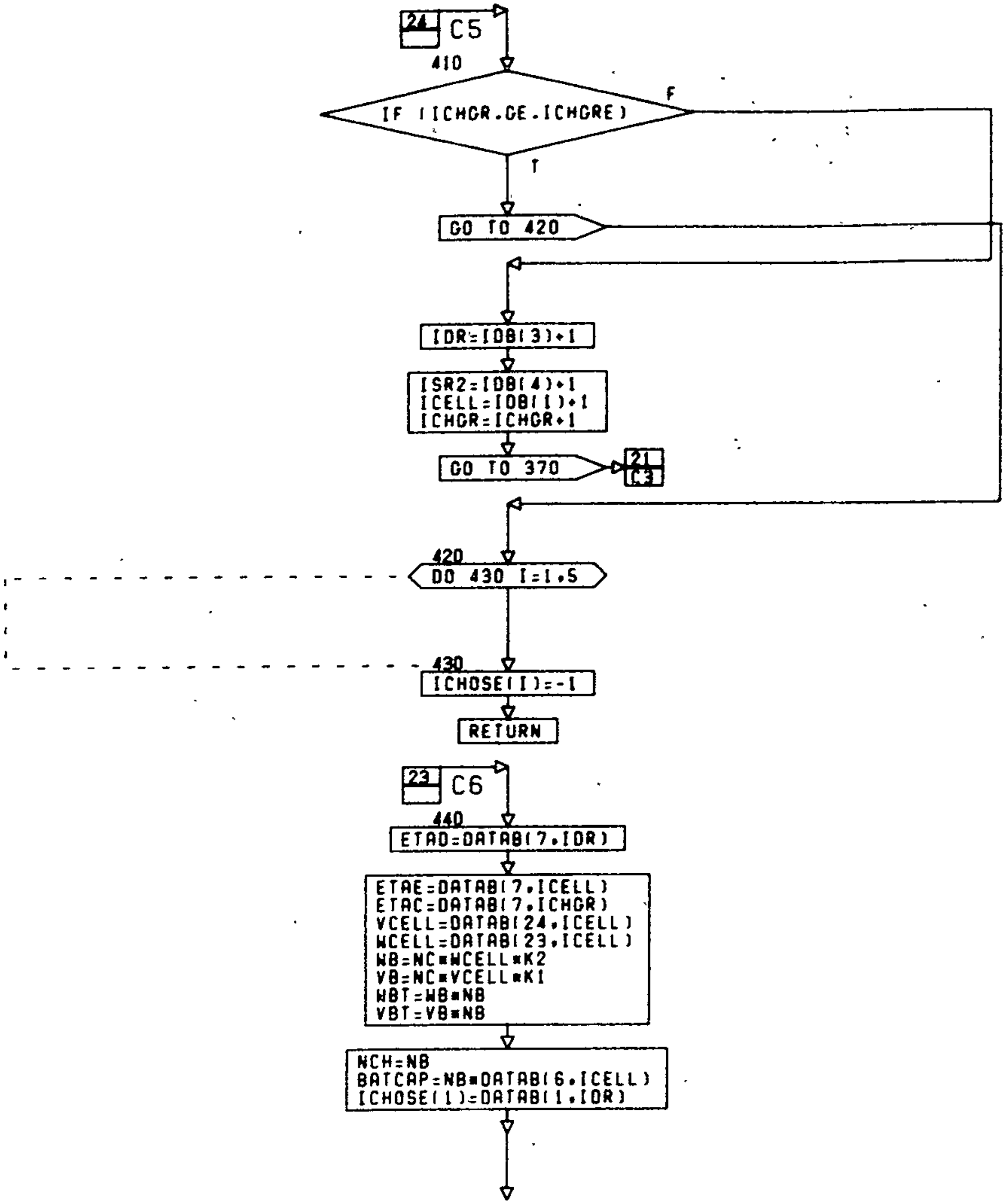

IF (ITER .GE. 1)
F
T
NB=NCHOSE(3)
CISTAR=CI/NB
C ** CHARGER SELECTION
C * DETERMINE CHARGE CURRENT RATING REQUIRED FOR THE BATTERY CHARGER *
CCELL=CISTAR
ICH=CCELL/CHMINT
C **
C **
C ** COMPARE THE HARDWARE PARAMETER TO THE SELECTION PARAMETER **
C **
C **
IF (DATAB(6,IDR).GE.PD.AND.DATAB(6,ISR2).GE.CAPMAX.AND.DATAB(6,ICE
LL).GE.CISTAR.AND.DATAB(6,ICHGR).GE.ICH)
F
T
GO TO 440
25
C6
IF (IDR.GE.IDRE)
F
T
GO TO 390
24
C4
IDR=IDR+1

CONT. ON PG 24

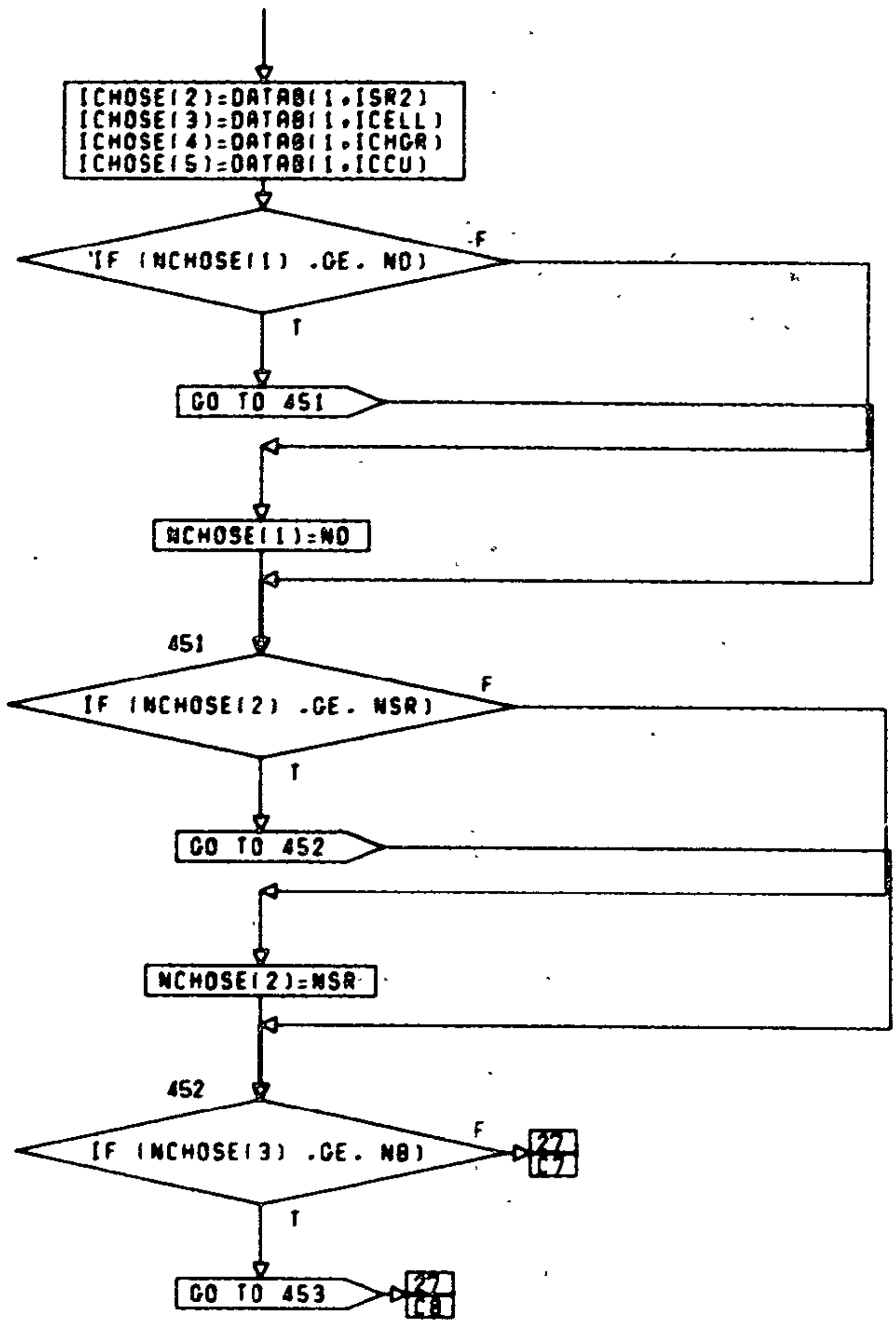


GO TO 370
21
C3
23
C4
390
IF (ISR2.GE.ISR2E)
F
T
GO TO 400
IDR=IDB(3)+1
ISR2=ISR2+1
GO TO 370
21
C3
400
IF (ICELL.GE.ICELLE)
F
T
GO TO 410
25
C5
IDR=IDB(3)+1
ISR2=IDB(4)+1
ICELL=ICELL+1
GO TO 370
21
C3

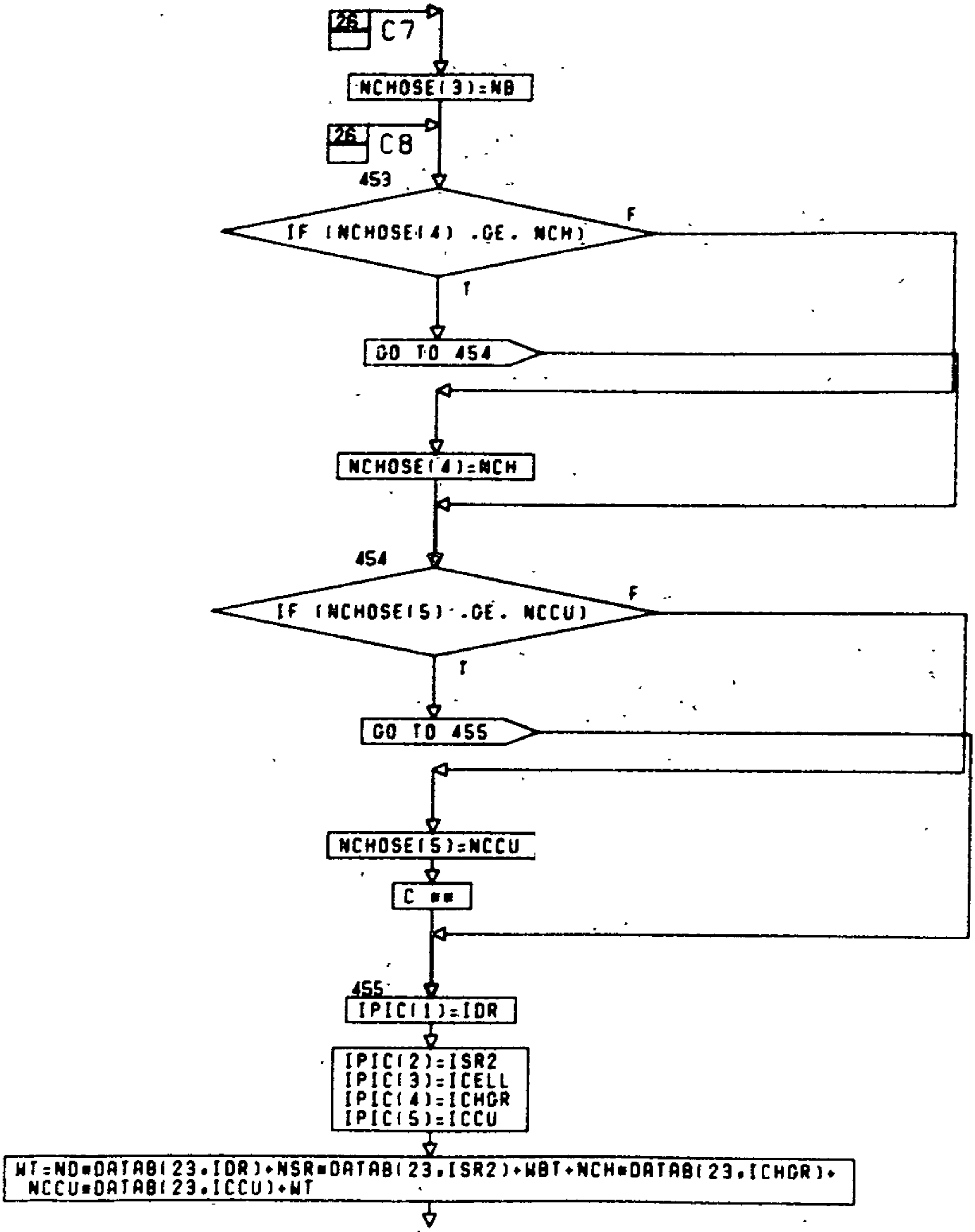
CONT. ON PG 25


24
C5
410
IF (ICHGR.GE.ICHGRE)
F
T
GO TO 420
IDR=IDB(3)+1
ISR2=IDB(4)+1
ICELL=IDB(1)+1
ICHGR=ICHGR+1
GO TO 370
21
C3
420
DO 430 I=1,5
430
ICHOSE(I)=-1
RETURN
23
C6
440
ETAD=DATAB(7,IDR)
ETAE=DATAB(7,ICELL)
ETAC=DATAB(7,ICHGR)
VCELL=DATAB(24,ICELL)
WCELL=DATAB(23,ICELL)
WB=NC*WCELL*K2
VB=NC*VCELL*K1
WBT=WB*NB
VBT=VB*NB
NCH=NB
BATCAP=NB*DATAB(6,ICELL)
ICHOSE(1)=DATAB(1,IDR)

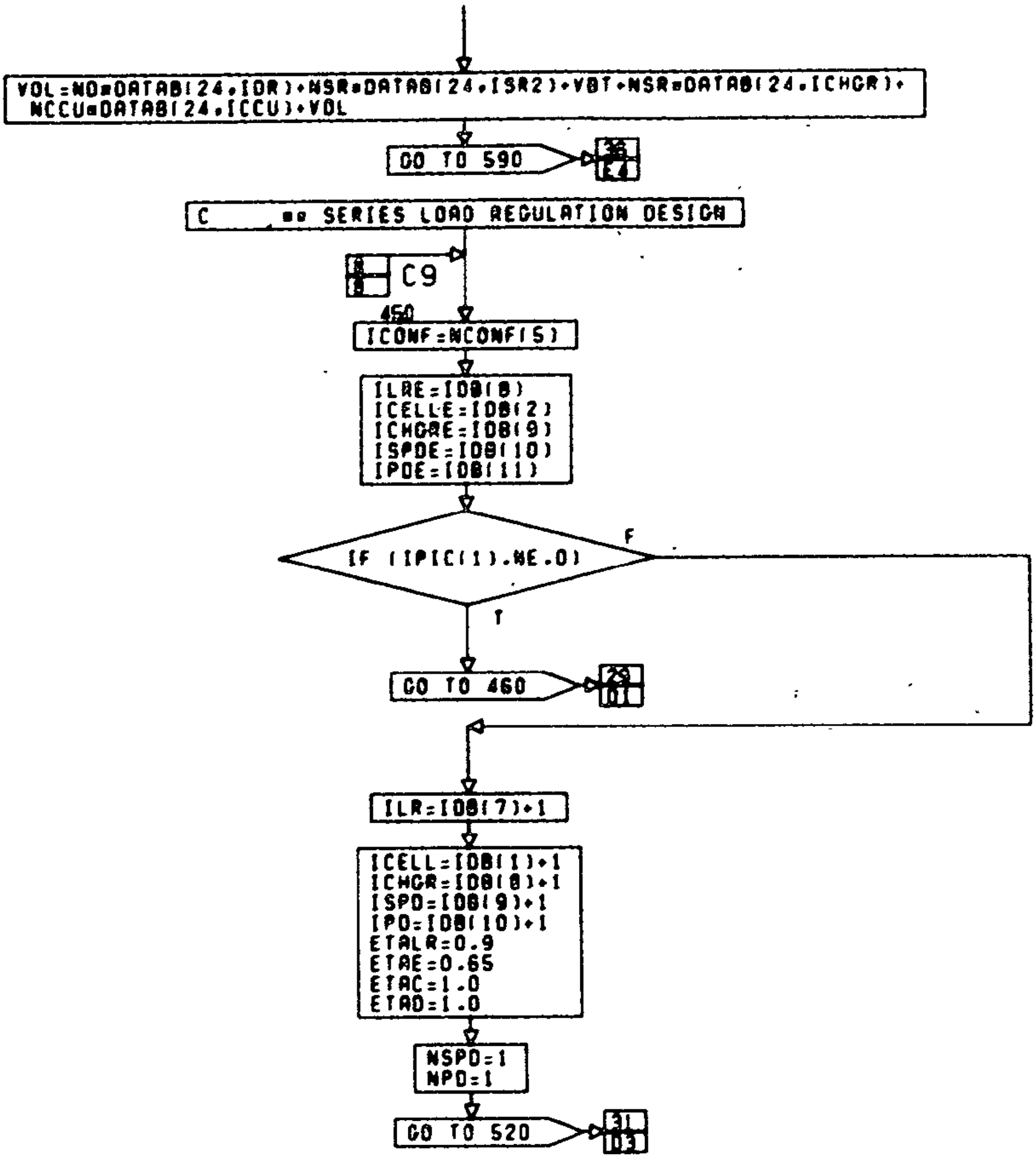
CONT. ON PG 26


ICHOSE(2)=DATAB(1,ISR2)
ICHOSE(3)=DATAB(1,ICELL)
ICHOSE(4)=DATAB(1,ICHGR)
ICHOSE(5)=DATAB(1,ICCU)
IF (NCHOSE(1) .GE. ND)
F
T
GO TO 451
NCHOSE(1)=ND
451
IF (NCHOSE(2) .GE. NSR)
F
T
GO TO 452
NCHOSE(2)=NSR
452
IF (NCHOSE(3) .GE. NB)
F
27
C7
T
GO TO 453
27
C8

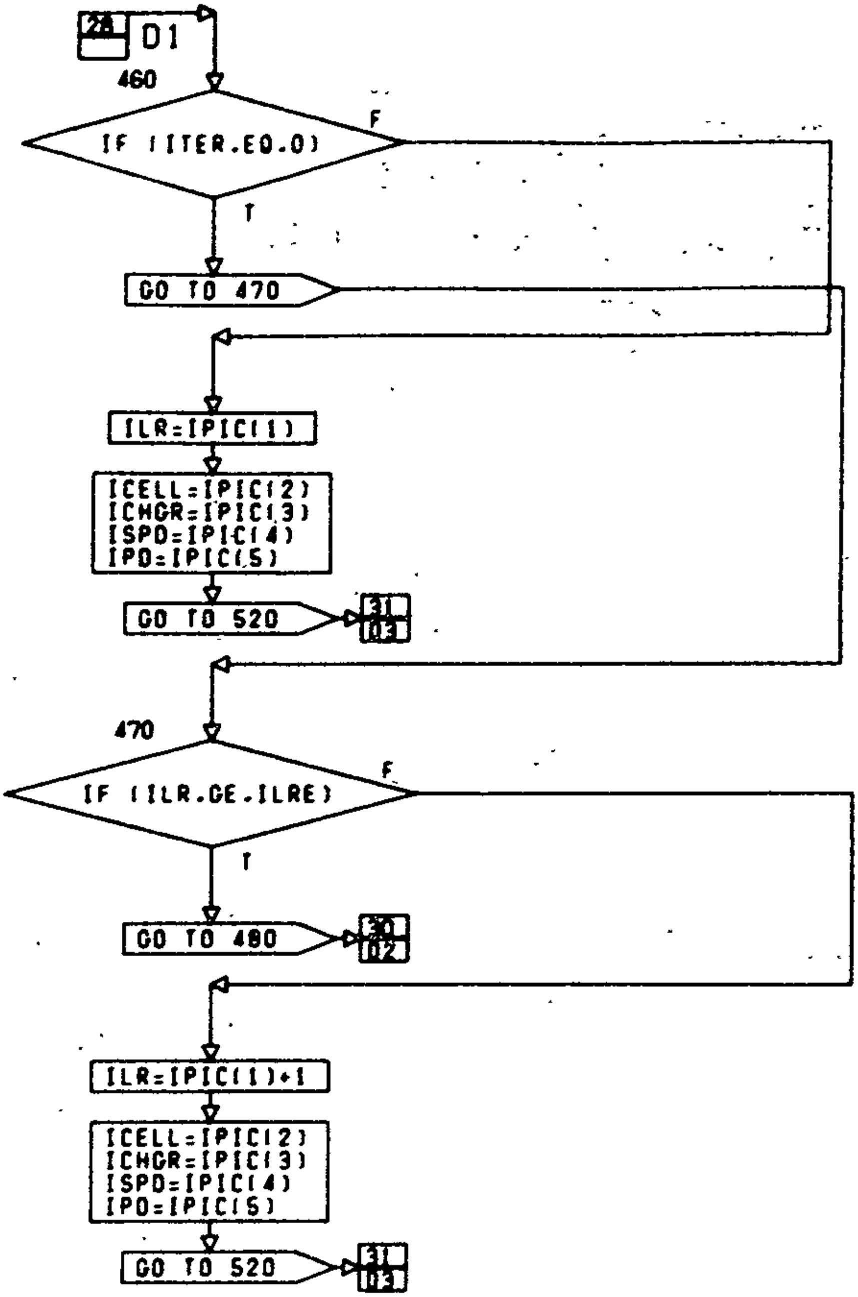
CONT. ON PG 27


26 C7
NCHOSE(3)=NB
26 C8
453
IF (NCHOSE(4) .GE. NCH)
F
T
GO TO 454
NCHOSE(4)=NCH
454
IF (NCHOSE(5) .GE. NCCU)
F
T
GO TO 455
NCHOSE(5)=NCCU
C **
455
IPIC(1)=IDR
IPIC(2)=ISR2
IPIC(3)=ICELL
IPIC(4)=ICHGR
IPIC(5)=ICCU
WT=ND*DATAB(23,IDR)+NSR*DATAB(23,ISR2)+WBT+NCH*DATAB(23,ICHGR)+
NCCU*DATAB(23,ICCU)+WT

CONT. ON PG 28

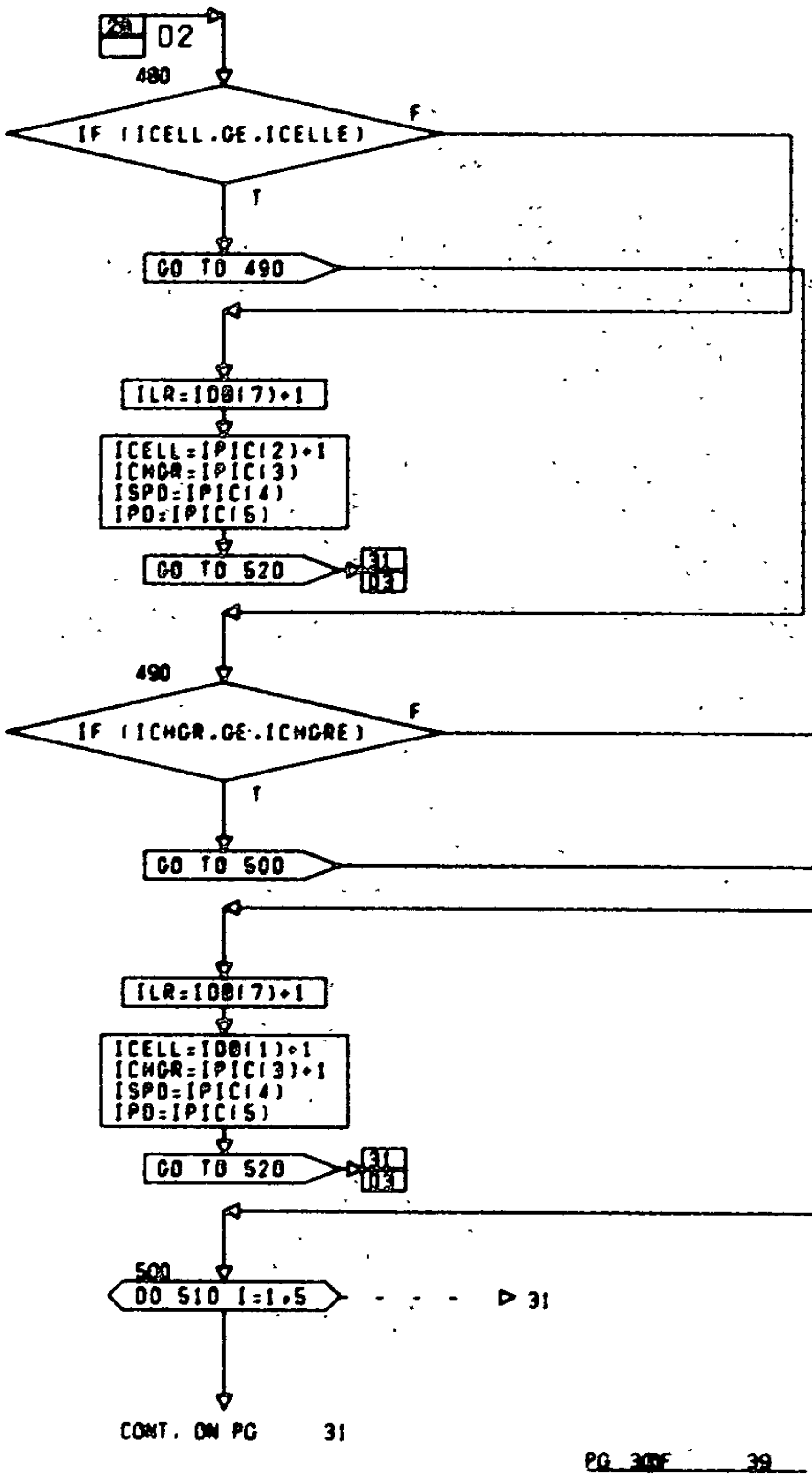

VOL=ND*DATAB(24,IDR)+NSR*DATAB(24,ISR2)+VBT+NSR*DATAB(24,ICHGR)+
NCCU*DATAB(24,ICCU)+VOL
GO TO 590
38
24
C ** SERIES LOAD REGULATION DESIGN
C9
450
ICONF=NCONF(5)
ILRE=IDB(8)
ICELLE=IDB(2)
ICHGRE=IDB(9)
ISPDE=IDB(10)
IPDE=IDB(11)
IF (IPIC(1).NE.0)
F
T
GO TO 460
29
01
ILR=IDB(7)+1
ICELL=IDB(1)+1
ICHGR=IDB(8)+1
ISPD=IDB(9)+1
IPD=IDB(10)+1
ETALR=0.9
ETAE=0.65
ETAC=1.0
ETAD=1.0
NSPD=1
NPD=1
GO TO 520
31
03

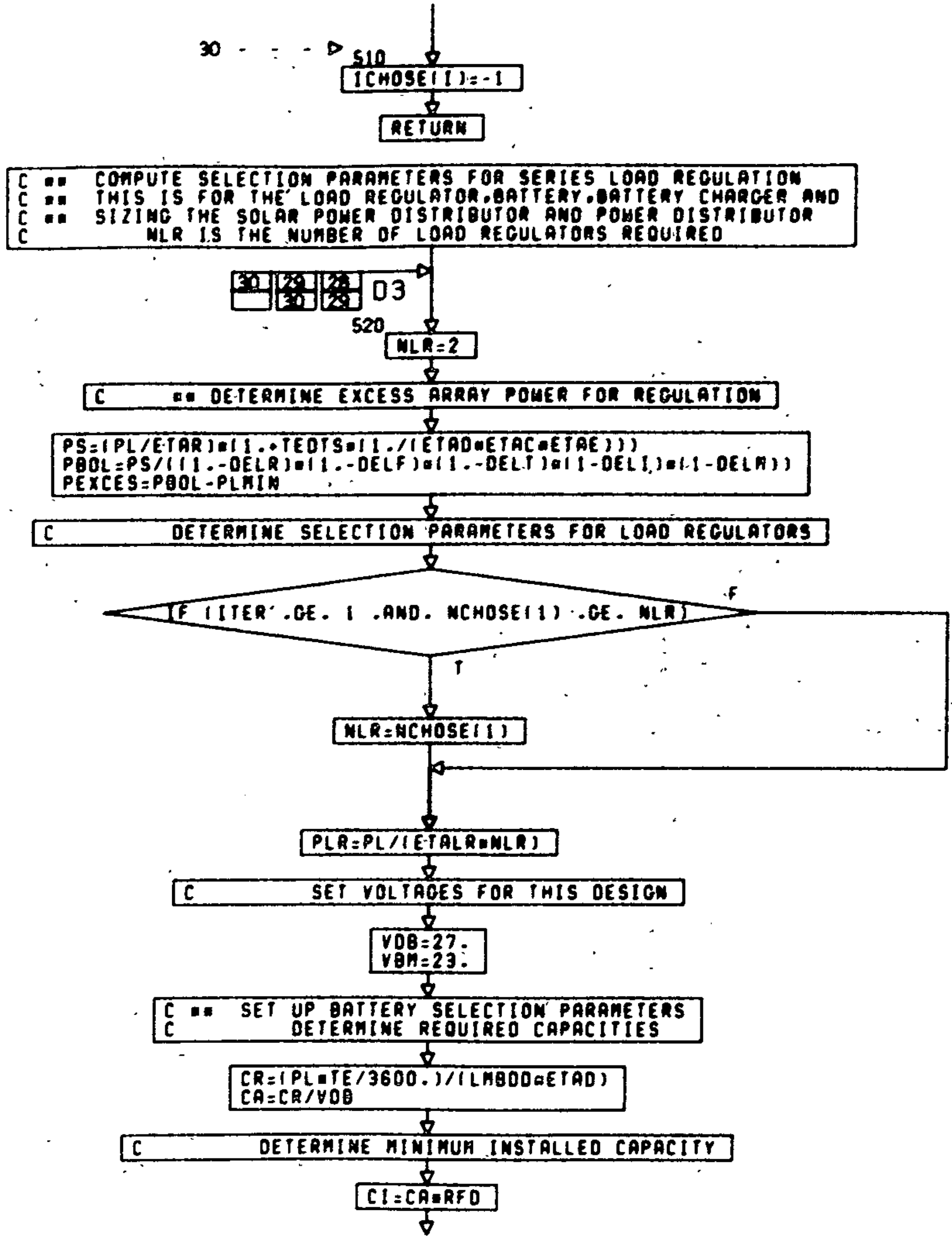
CONT. ON PG 29



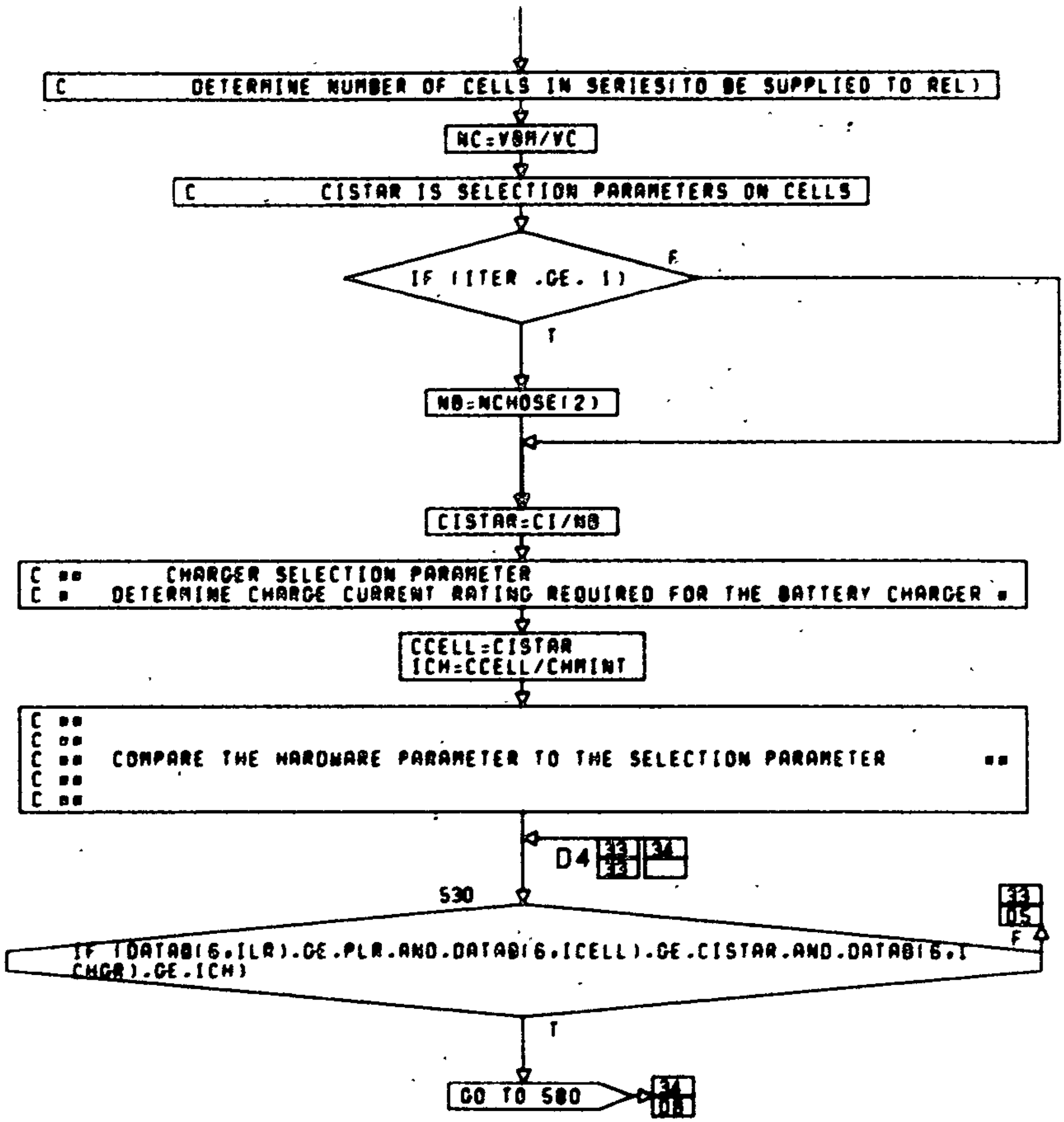
2A
D1
460
IF (ITER.EQ.0)
F
T
GO TO 470
ILR=IPIC(1)
ICELL=IPIC(2)
ICHGR=IPIC(3)
ISPD=IPIC(4)
IPD=IPIC(5)
GO TO 520
31
D3
470
IF (ILR.GE.ILRE)
F
T
GO TO 480
30
D2
ILR=IPIC(1)+1
ICELL=IPIC(2)
ICHGR=IPIC(3)
ISPD=IPIC(4)
IPD=IPIC(5)
GO TO 520
31
D3

CONT. ON PG 30

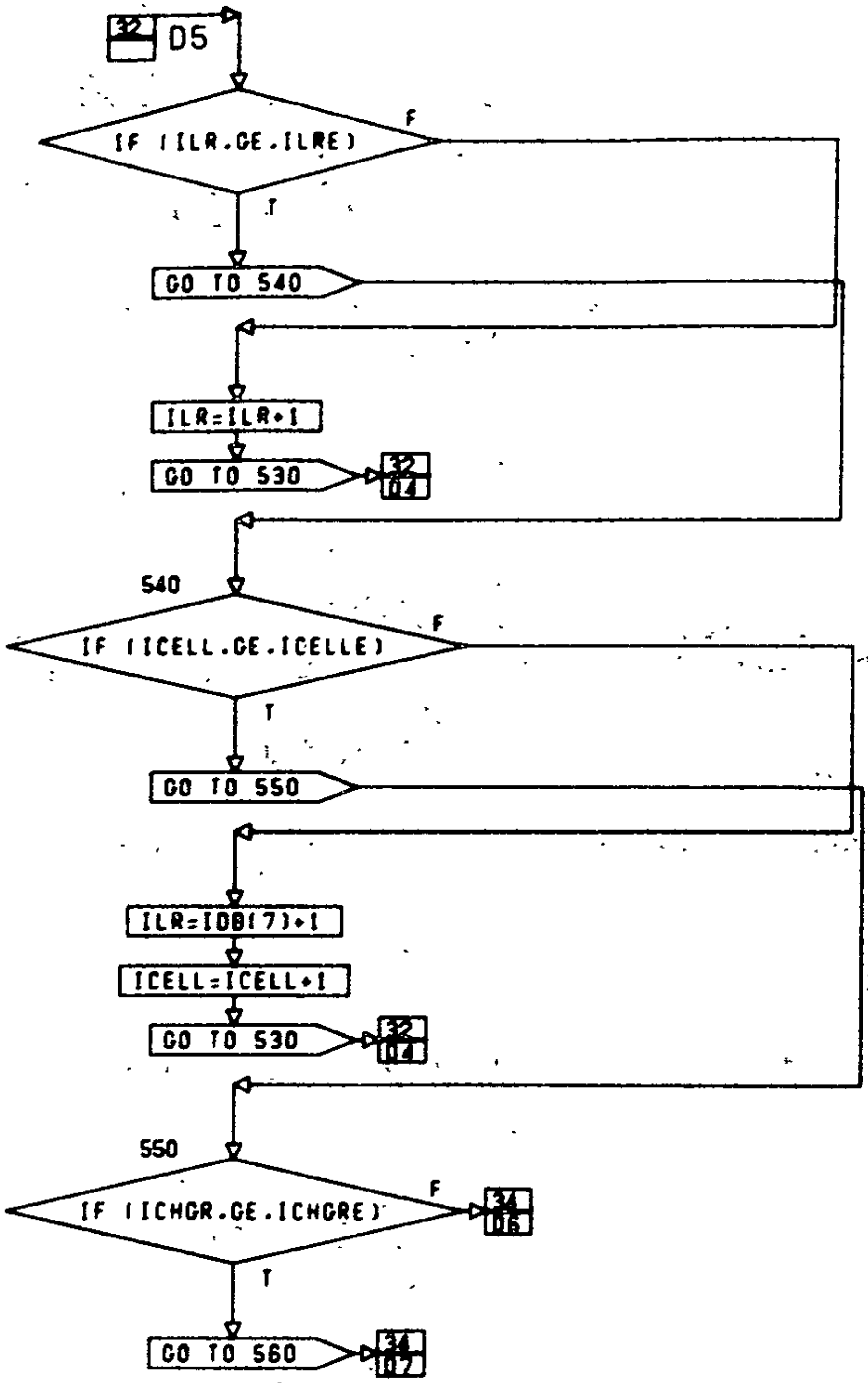

29
D2
480
IF (ICELL.GE.ICELLE)
F
T
GO TO 490
ILR=IDB(7)+1
ICELL=IPIC(2)+1
ICHGR=IPIC(3)
ISPD=IPIC(4)
IPD=IPIC(5)
GO TO 520
31
D3
490
IF (ICHGR.GE.ICHGRE)
F
T
GO TO 500
ILR=IDB(7)+1
ICELL=IDB(1)+1
ICHGR=IPIC(3)+1
ISPD=IPIC(4)
IPD=IPIC(5)
GO TO 520
31
D3
500
DO 510 I=1,5
31
CONT. ON PG 31
PG 30 OF 39


30
510
ICHOSE(I)=-1
RETURN
C ** COMPUTE SELECTION PARAMETERS FOR SERIES LOAD REGULATION
C ** THIS IS FOR THE LOAD REGULATOR,BATTERY,BATTERY CHARGER AND
C ** SIZING THE SOLAR POWER DISTRIBUTOR AND POWER DISTRIBUTOR
C NLR IS THE NUMBER OF LOAD REGULATORS REQUIRED
30
29
30
28
29
D3
520
NLR=2
C ** DETERMINE EXCESS ARRAY POWER FOR REGULATION
PS=(PL/ETAR)*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))
PBOL=PS/((1.-DELR)*(1.-DELF)*(1.-DELT)*(1-DELI)*(1-DELM))
PEXCES=PBOL-PLMIN
C DETERMINE SELECTION PARAMETERS FOR LOAD REGULATORS
IF (ITER .GE. 1 .AND. NCHOSE(1) .GE. NLR)
F
T
NLR=NCHOSE(1)
PLR=PL/(ETALR*NLR)
C SET VOLTAGES FOR THIS DESIGN
VDB=27.
VBM=23.
C ** SET UP BATTERY SELECTION PARAMETERS
C DETERMINE REQUIRED CAPACITIES
CR=(PL*TE/3600.)/(LMBOD*ETAD)
CA=CR/VDB
C DETERMINE MINIMUM INSTALLED CAPACITY
CI=CA*RFD

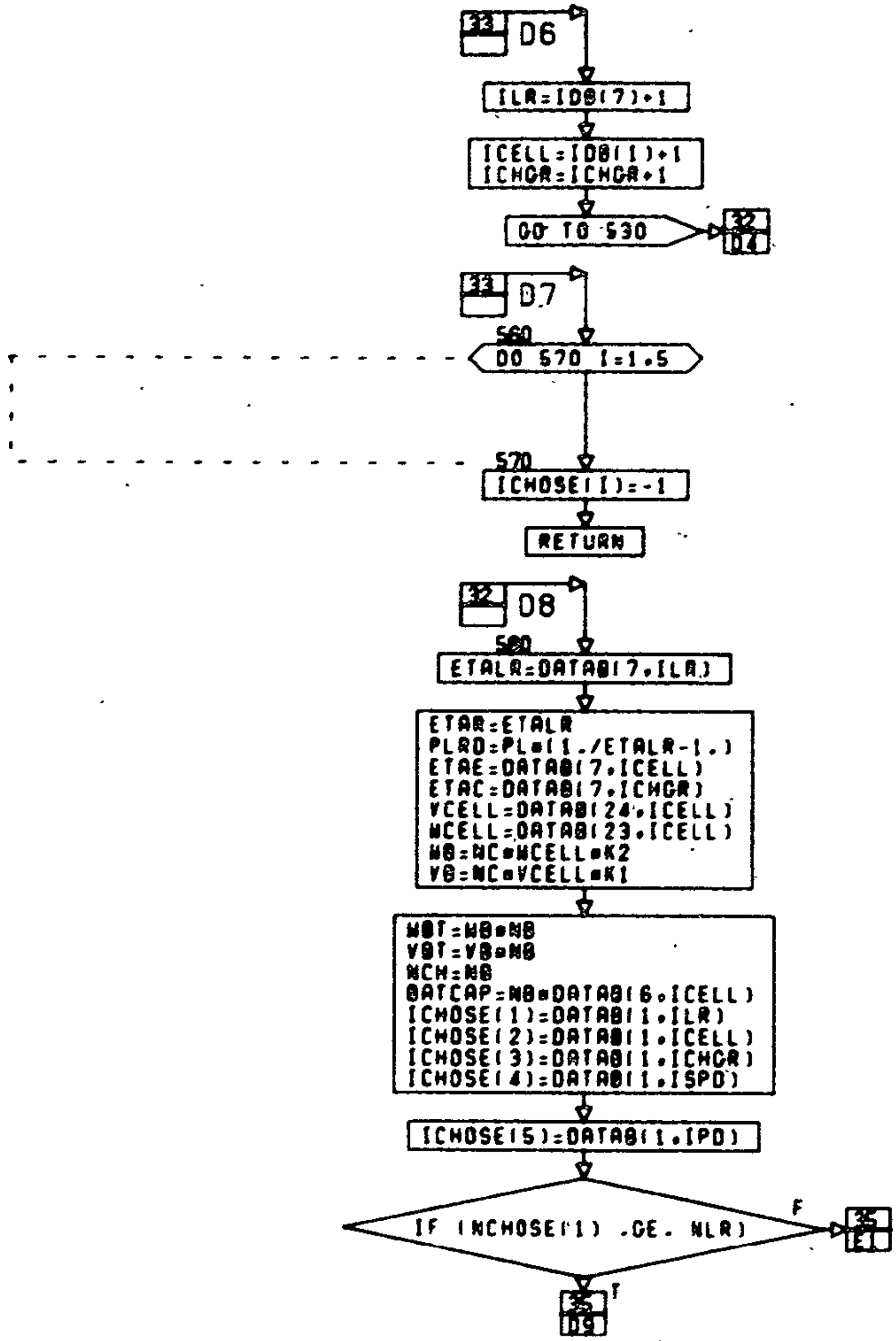
CONT. ON PG 32


C DETERMINE NUMBER OF CELLS IN SERIES(TO BE SUPPLIED TO REL)
NC=VBM/VC
C CISTAR IS SELECTION PARAMETERS ON CELLS
IF (ITER .GE. 1)
F
T
NB=NCHOSE(2)
CISTAR=CI/NB
C ** CHARGER SELECTION PARAMETER
C * DETERMINE CHARGE CURRENT RATING REQUIRED FOR THE BATTERY CHARGER *
CCELL=CISTAR
ICH=CCELL/CHMINT
C **
C **
C ** COMPARE THE HARDWARE PARAMETER TO THE SELECTION PARAMETER **
C **
C **
D4
33
33
34
530
33
05
F
IF (DATAB(6,ILR).GE.PLR.AND.DATAB(6,ICELL).GE.CISTAR.AND.DATAB(6,ICHGR).GE.ICH)
T
GO TO 580
34
08

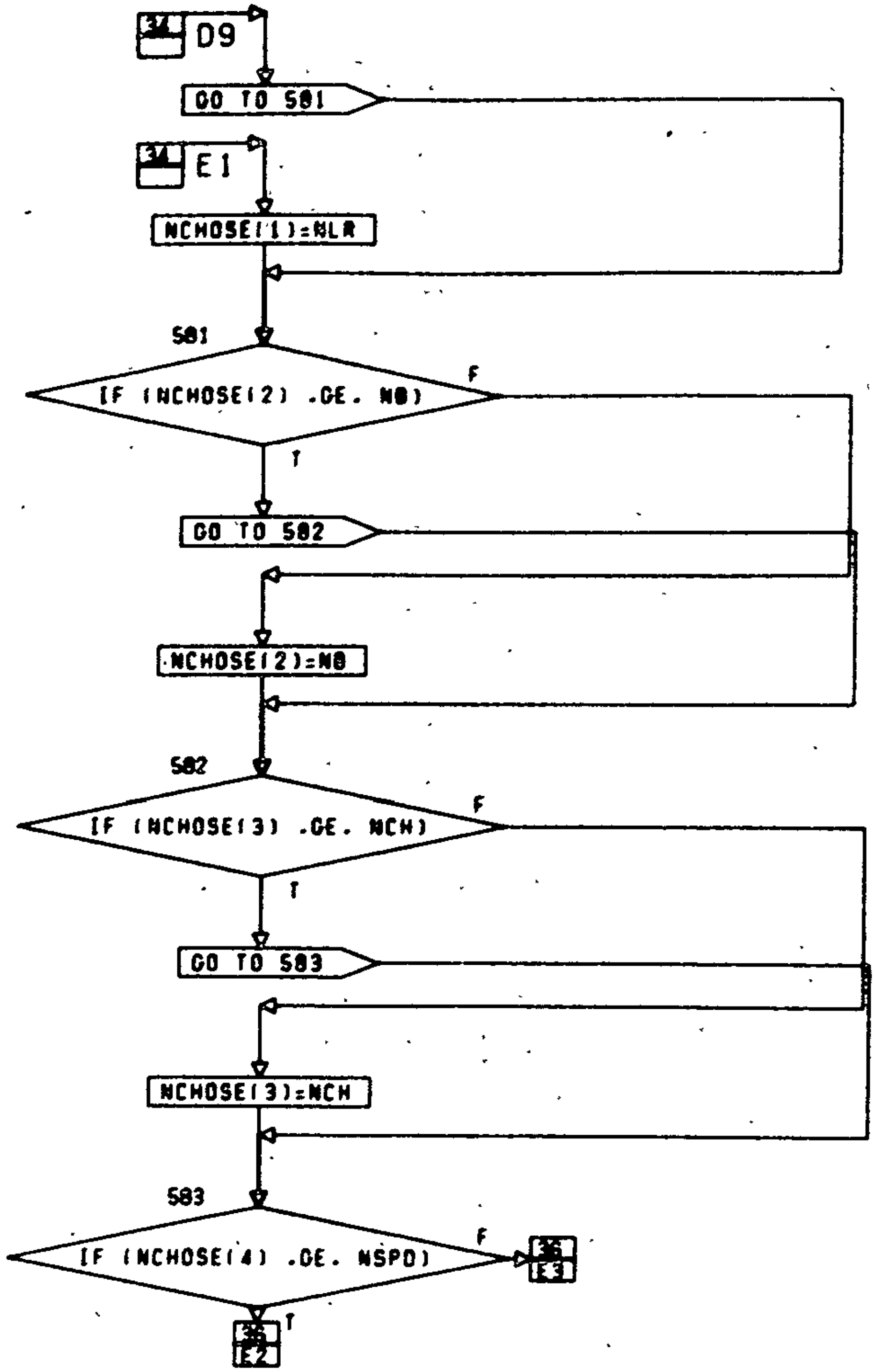
CONT. ON PG 33


32
D5
IF (ILR.GE.ILRE)
F
T
GO TO 540
ILR=ILR+1
GO TO 530
32
D4
540
IF (ICELL.GE.ICELLE)
F
T
GO TO 550
ILR=IDB(7)+1
ICELL=ICELL+1
GO TO 530
32
D4
550
IF (ICHGR.GE.ICHGRE)
F
34
D6
T
GO TO 560
34
D7

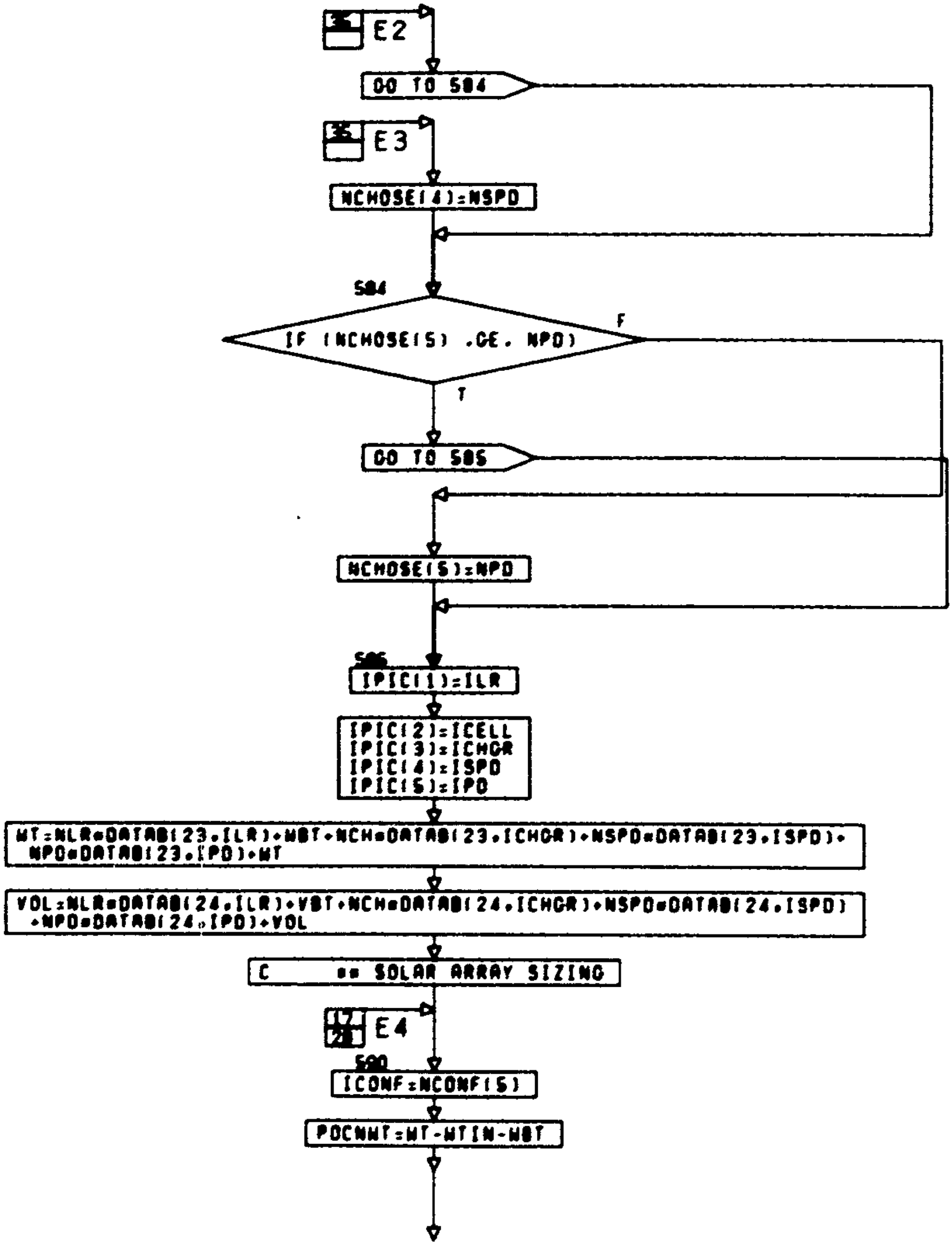
CONT. ON PG 34


33
D6
ILR=IDB(7)+1
ICELL=IDB(1)+1
ICHGR=ICHGR+1
GO TO 530
32
D4
33
D7
560
DO 570 I=1,5
570
ICHOSE(I)=-1
RETURN
32
D8
580
ETALR=DATAB(7,ILR)
ETAR=ETALR
PLRD=PL*(1./ETALR-1.)
ETAE=DATAB(7,ICELL)
ETAC=DATAB(7,ICHGR)
VCELL=DATAB(24,ICELL)
WCELL=DATAB(23,ICELL)
WB=NC*WCELL*K2
VB=NC*VCELL*K1
WBT=WB*NB
VBT=VB*NB
WCH=NB
BATCAP=NB*DATAB(6,ICELL)
ICHOSE(1)=DATAB(1,ILR)
ICHOSE(2)=DATAB(1,ICELL)
ICHOSE(3)=DATAB(1,ICHGR)
ICHOSE(4)=DATAB(1,ISPD)
ICHOSE(5)=DATAB(1,IPD)
IF (NCHOSE(1) .GE. NLR)
F
35
E1
T
35
D9

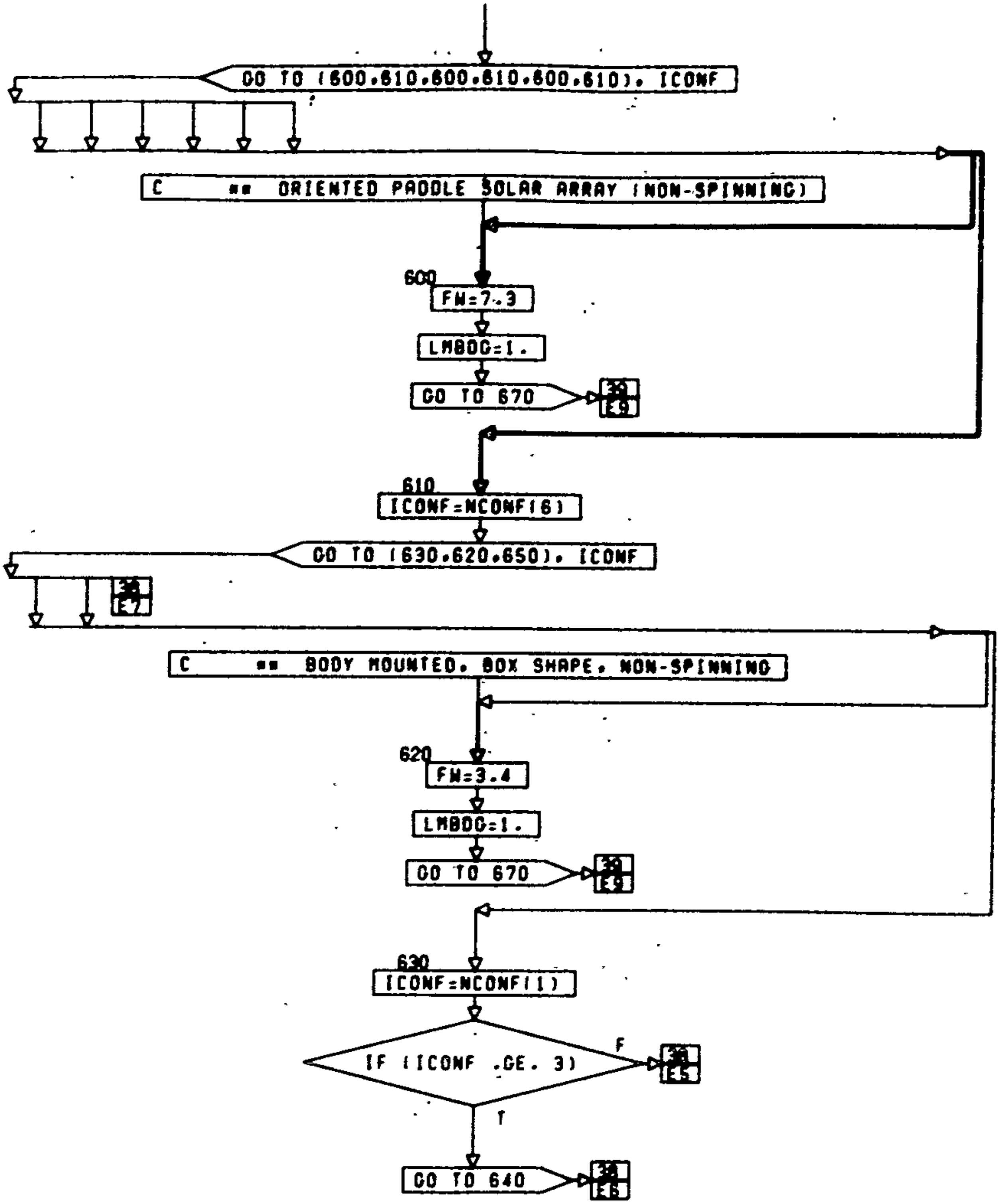
CONT. ON PG 35


34
D9
GO TO 581
34
E1
NCHOSE(1)=NLR
581
IF (NCHOSE(2) .GE. NB)
F
T
GO TO 582
NCHOSE(2)=NB
582
IF (NCHOSE(3) .GE. NCH)
F
T
GO TO 583
NCHOSE(3)=NCH
583
IF (NCHOSE(4) .GE. NSPD)
F
36
E3
T
36
E2

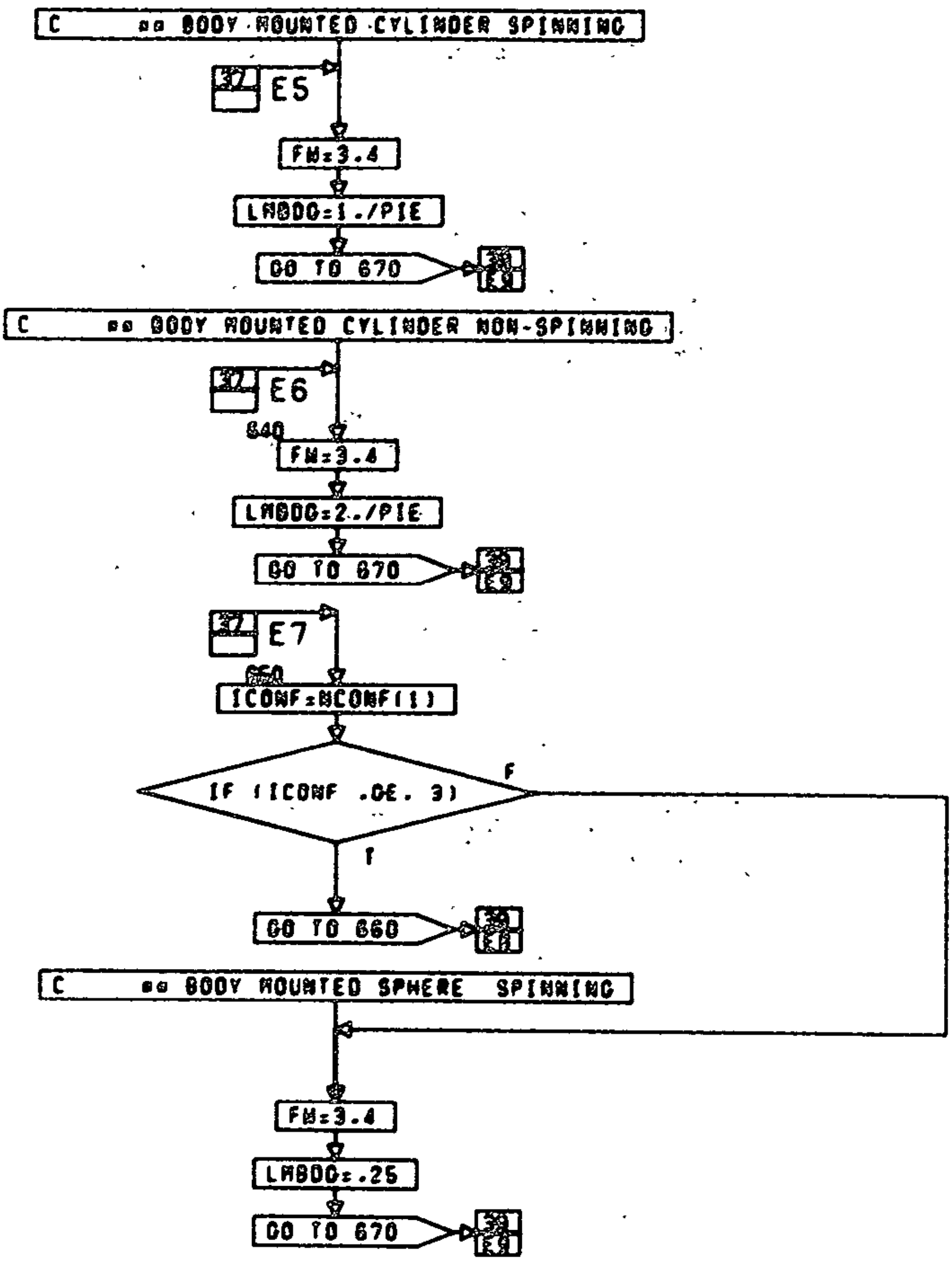
CONT. ON PG 36


E2
GO TO 584
E3
NCHOSE(4)=NSPD
584
IF (NCHOSE(5) .GE. NPD)
F
T
GO TO 585
NCHOSE(5)=NPD
585
IPIC(1)=ILR
IPIC(2)=ICELL
IPIC(3)=ICHGR
IPIC(4)=ISPD
IPIC(5)=IPD
WT=NLR*DATAB(23,ILR)+WBT+NCH*DATAB(23,ICHGR)+NSPD*DATAB(23,ISPD)+
NPD*DATAB(23,IPD)+WT
VOL=NLR*DATAB(24,ILR)+VBT+NCH*DATAB(24,ICHGR)+NSPD*DATAB(24,ISPD)
+NPD*DATAB(24,IPD)+VOL
C ** SOLAR ARRAY SIZING
17
28
E4
590
ICONF=NCONF(5)
POCWWT=WT-WTIN-WBT

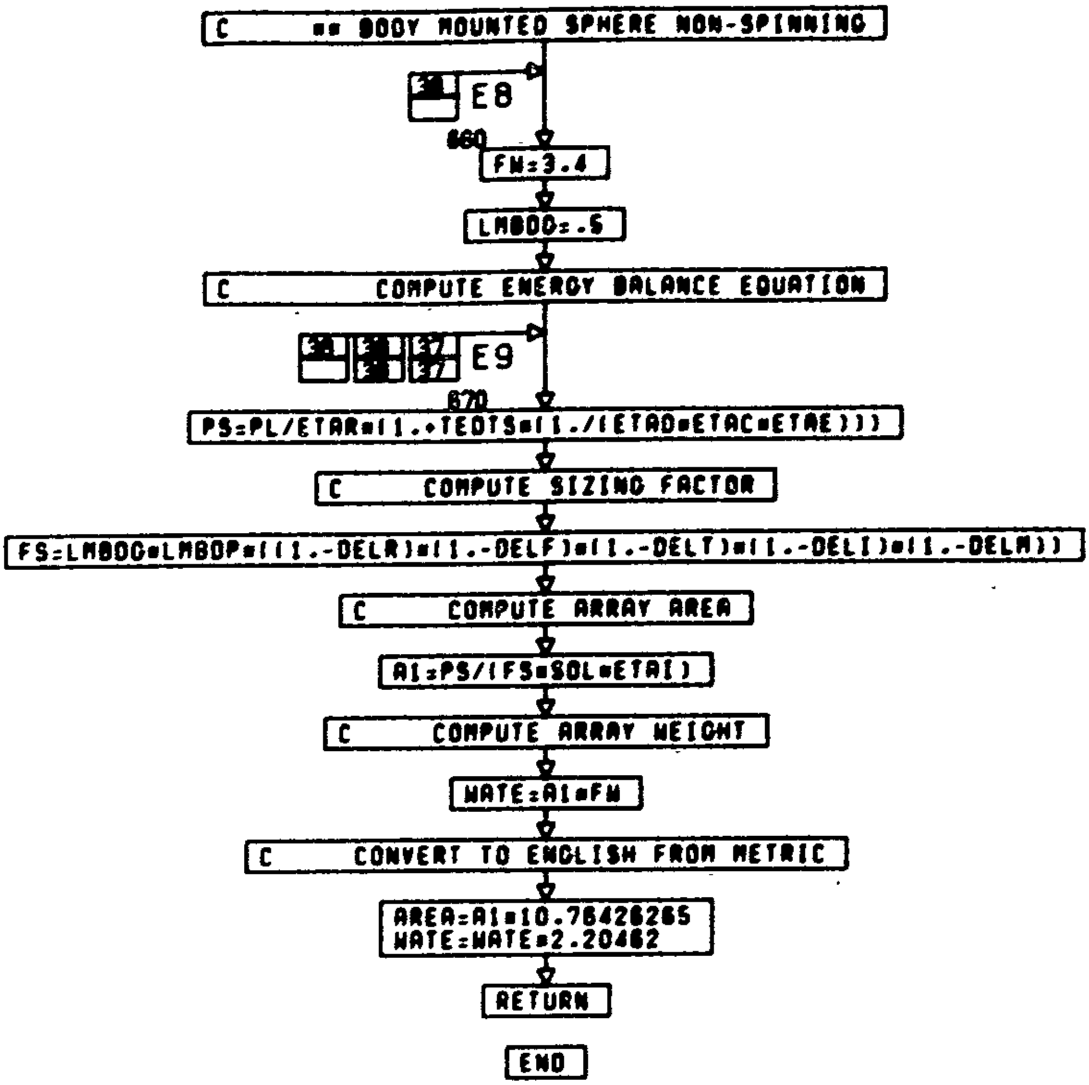
CONT. ON PG 37


GO TO (600,610,600,610,600,610), ICONF
C ** ORIENTED PADDLE SOLAR ARRAY (NON-SPINNING)
600
FM=7.3
LMBDG=1.
GO TO 670
39
E9
610
ICONF=NCONF(6)
GO TO (630,620,650), ICONF
38
E7
C ** BODY MOUNTED, BOX SHAPE, NON-SPINNING
620
FM=3.4
LMBDG=1.
GO TO 670
39
E9
630
ICONF=NCONF(1)
IF (ICONF .GE. 3)
F
38
E5
T
GO TO 640
38
E6

CONT. ON PG 38


C ** BODY MOUNTED CYLINDER SPINNING
37
E5
FM=3.4
LMBDO=1./PIE
GO TO 670
38
E9
C ** BODY MOUNTED CYLINDER NON-SPINNING
37
E6
640
FM=3.4
LMBDO=2./PIE
GO TO 670
38
E9
37
E7
650
ICONF=NCONF(I)
IF (ICONF .GE. 3)
F
T
GO TO 660
38
E8
C ** BODY MOUNTED SPHERE SPINNING
FM=3.4
LMBDO=.25
GO TO 670
38
E9

CONT. ON PG 39


C ** BODY MOUNTED SPHERE NON-SPINNING
E8
860
FW=3.4
LMBOD=.5
C COMPUTE ENERGY BALANCE EQUATION
E9
870
PS=PL/ETAR*(1.+TEDTS*(1./(ETAD*ETAC*ETAE)))
C COMPUTE SIZING FACTOR
FS=LMBOD*LMBOP*((1.-DELR)*(1.-DELF)*(1.-DELT)*(1.-DELI)*(1.-DELM))
C COMPUTE ARRAY AREA
AI=PS/(FS*SOL*ETAI)
C COMPUTE ARRAY WEIGHT
WATE=AI*FW
C CONVERT TO ENGLISH FROM METRIC
AREA=AI*10.76426265
WATE=WATE*2.20462
RETURN
END

PG 39 FINAL

```
SUBROUTINE AUXPRO (IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)
```

```
COMMON /USERI/   APODEE,   COMRAT,   DIAMAX, EEOWT(9),    EPME,
                 EOM1WT,   EOM1XL,   EOM1YL,   EOM1ZL,  EOM2WT,
                 EOM2XL,   EOM2YL,   EOM2ZL,    TTHST,  IAGNCY,
         IDEBUG, ISATOR,   MB12SH,   OPTEMP,   ORBINC,  PERIGE,
          MICRO,  RELME,  SPEC(6),    SPEC1,    XDUM1,  XCGSA1,
                   XMER,     XMEU
```

```
COMMON /BTWN/     ACSSN,    ACSWP,      ALT,     AREA,  BATCAP,
              BITRAT(2),    CLIFE,   CONVWT,        D,      DT,
                     DX,       DY,       DZ,    EOBLG,  EOBSID,
                     FC,   ACTHST,   HARNWT,      HPT,  HTPIPE,
                   HTPT,   HTRPRB,   HTRPWR,            IBTLOC,
                  LMBDD,       NC,   OMEOS,    PASSTR,      PJ,
                     PL,    PLMIN,   PDCNWT,     RADA,   RADAB,
                    RAT,       RJ,   SABOLG,    SATLG,  SATTWT,
```

```
                  SATWT,   SATXCG,   SATYCG,   SATZCG,   SA1XL,
                  SA1YL,    SA1ZL,     SIDE,    SYSLB,  THCMWT,
                   T(2),   TOTIMP,    TNKWT,    TPRIM,      VB,
                   VCHP,      VOL,     WATE,       WB,     WBT,
                     WT,       XJ,   XNZERO,       YJ,      ZJ
```

```
COMMON /DBCOM/DATAB(55,100),IDB(30)
```

```
COMMON/PRTCOM/    ACCRCY,        AM,        AN,        BF,        BS,
                CDPI(7,2),    CISTAR,      CTOT,      DDTE,        DE,
                   DRIWT,    EOBSTR,    FEEINV,    FEEOPS,      FEER,
                     GSE,      IREL,    ITRUNC,  MMDOLD,NAME(3,60),
                     OPS,    PAYINV,    PAYOUL,      PAYR,        PE,
                     PMP,       PMR,  POWER(6),        PU,   PWR(60),
                     OCP,       OCR,  ROLD(60),    SABMNT,    SATADP,
                  SATINV,      SATR,      SEIP,      SEIR,  SKTAU(6),
```

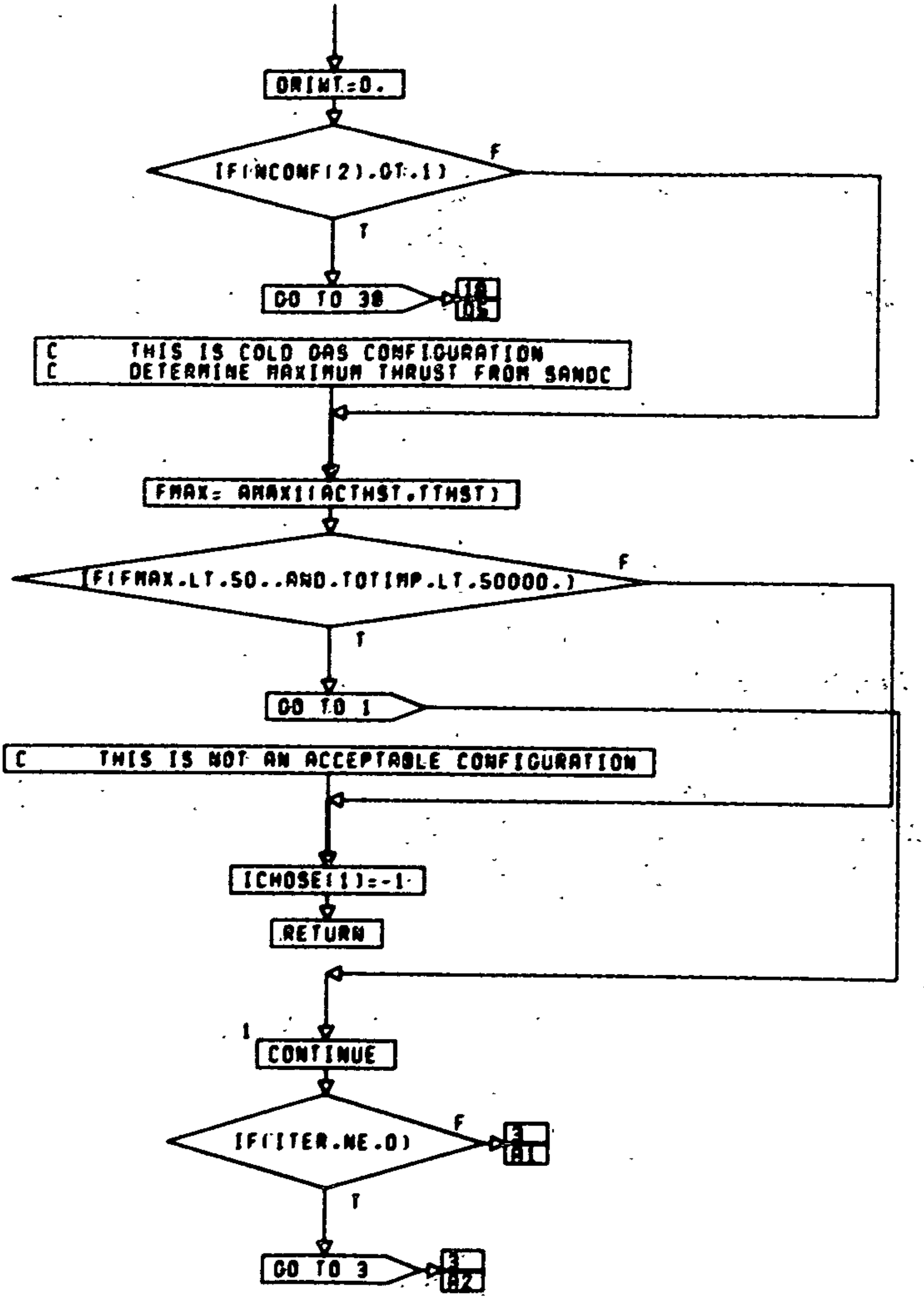
```
               SSREL(6),   SUBE(7),   SUBT(7),  SUBUE(7),  SUBUP(7),
                     TA,  TAU(6,6),        TB,        TC,        TE,
                     TF,     TOOLR,     TOOLU,    TOTOPS,     TRUNC,
                     TS,       TTT,VOLUME(6),   VOL(60),WEIGHT(6),
                  XLTOT,      XMEH,    XMEINV,      XMEL,     XMEVL,
                   XMEW,     XMEWT,     XVEST
```

```
DIMENSION IPIC(9),NCONF(6),ICHOSE(14),NCHOSE(14),
 IACCPT(20)
```

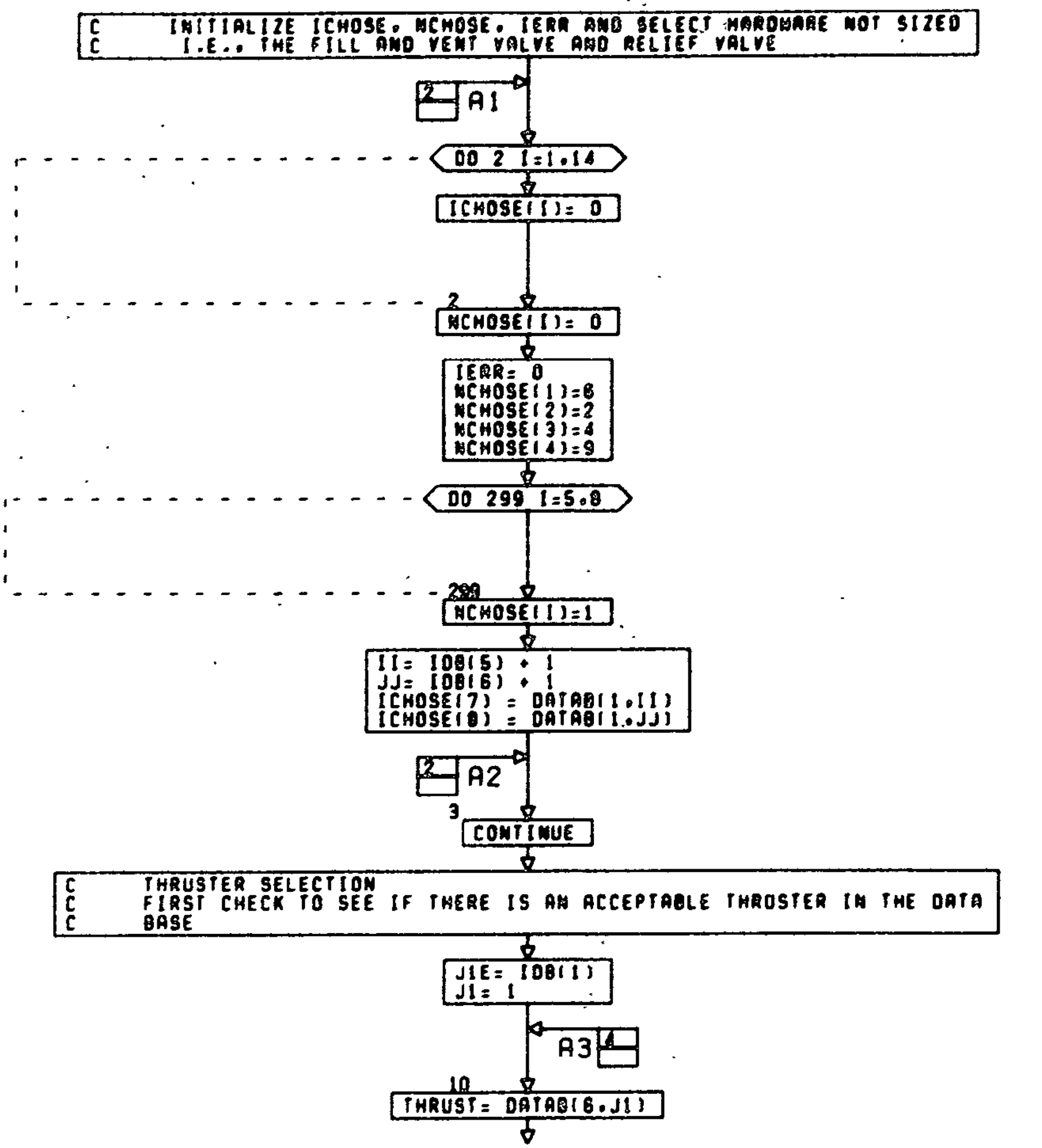
```
DIMENSION W(14)
DATA XMR/1.5/
PRINT 9000,ACTHST,TTHST
```

```
9000
FORMAT (1X,9HACTHST = ,E11.4,1X,8HTTHST = ,E11.4)
```

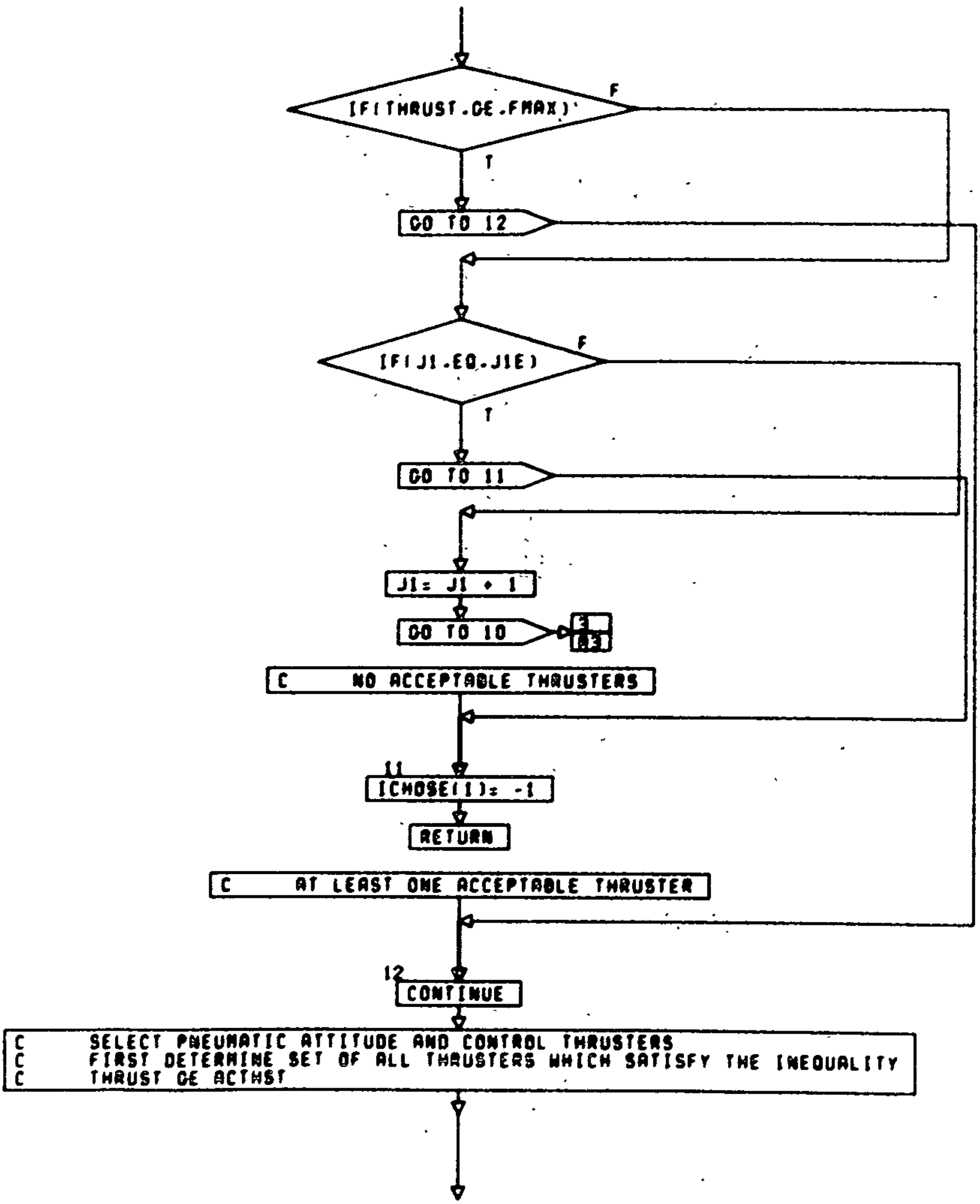
CONT. ON PG 2


ORINT=0.
IF(NCONF(2).GT.1)
F
T
GO TO 38
C THIS IS COLD GAS CONFIGURATION
C DETERMINE MAXIMUM THRUST FROM SANDC
FMAX= AMAX1(ACTHST,TTHST)
IF(FMAX.LT.50..AND.TOTIMP.LT.50000.)
F
T
GO TO 1
C THIS IS NOT AN ACCEPTABLE CONFIGURATION
ICHOSE(1)=-1
RETURN
1
CONTINUE
IF(ITER.NE.0)
F
T
GO TO 3

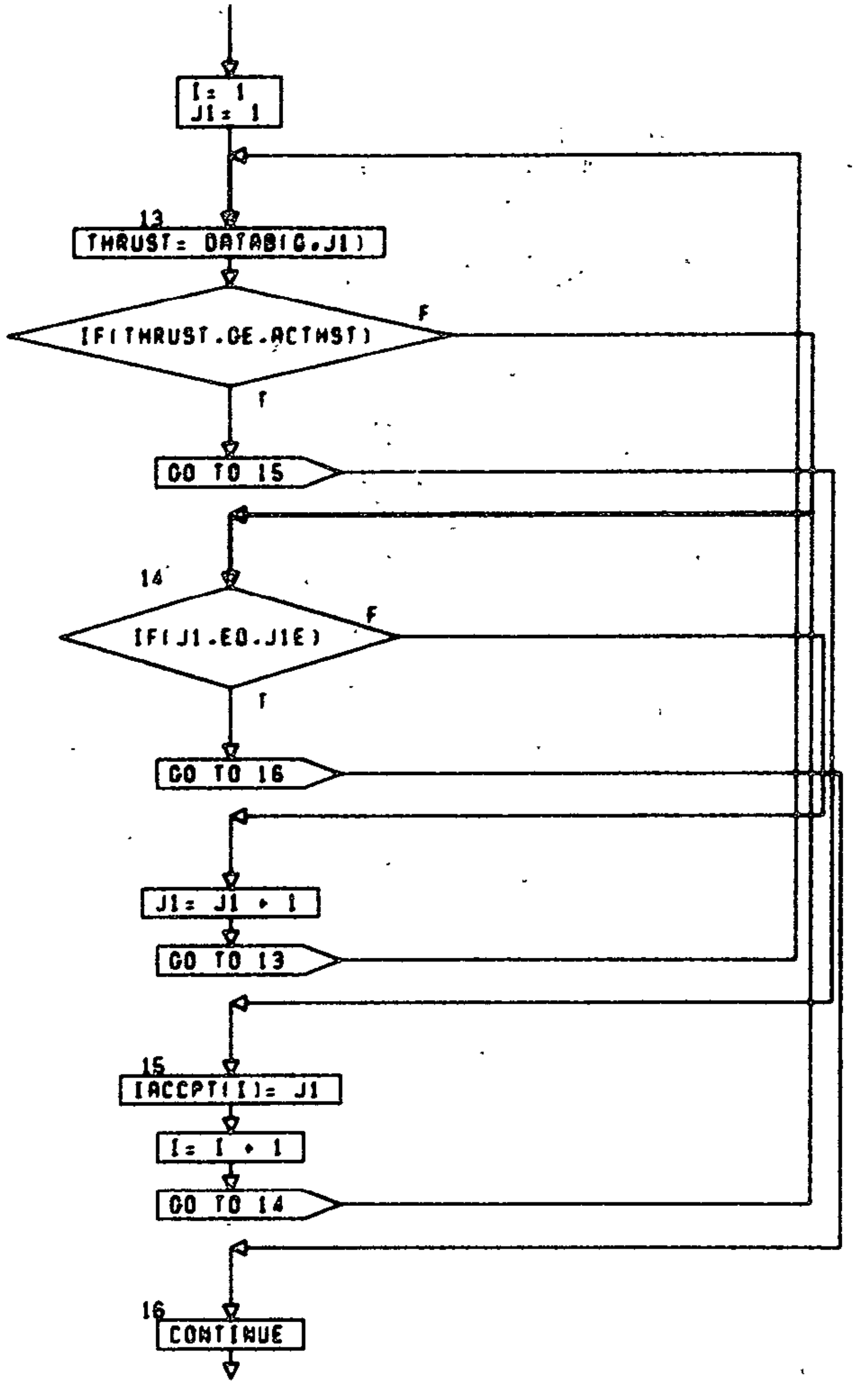
CONT. ON PG 3


C INITIALIZE ICHOSE, NCHOSE, IERR AND SELECT HARDWARE NOT SIZED
C I.E., THE FILL AND VENT VALVE AND RELIEF VALVE
2
A1
DO 2 I=1,14
ICHOSE(I)= 0
2
NCHOSE(I)= 0
IERR= 0
NCHOSE(1)=6
NCHOSE(2)=2
NCHOSE(3)=4
NCHOSE(4)=9
DO 299 I=5,8
299
NCHOSE(I)=1
II= IDB(5) + 1
JJ= IDB(6) + 1
ICHOSE(7) = DATAB(1,II)
ICHOSE(8) = DATAB(1,JJ)
2
A2
3
CONTINUE
C THRUSTER SELECTION
C FIRST CHECK TO SEE IF THERE IS AN ACCEPTABLE THRUSTER IN THE DATA
C BASE
J1E= IDB(1)
J1= 1
A3
4
10
THRUST= DATAB(6,J1)

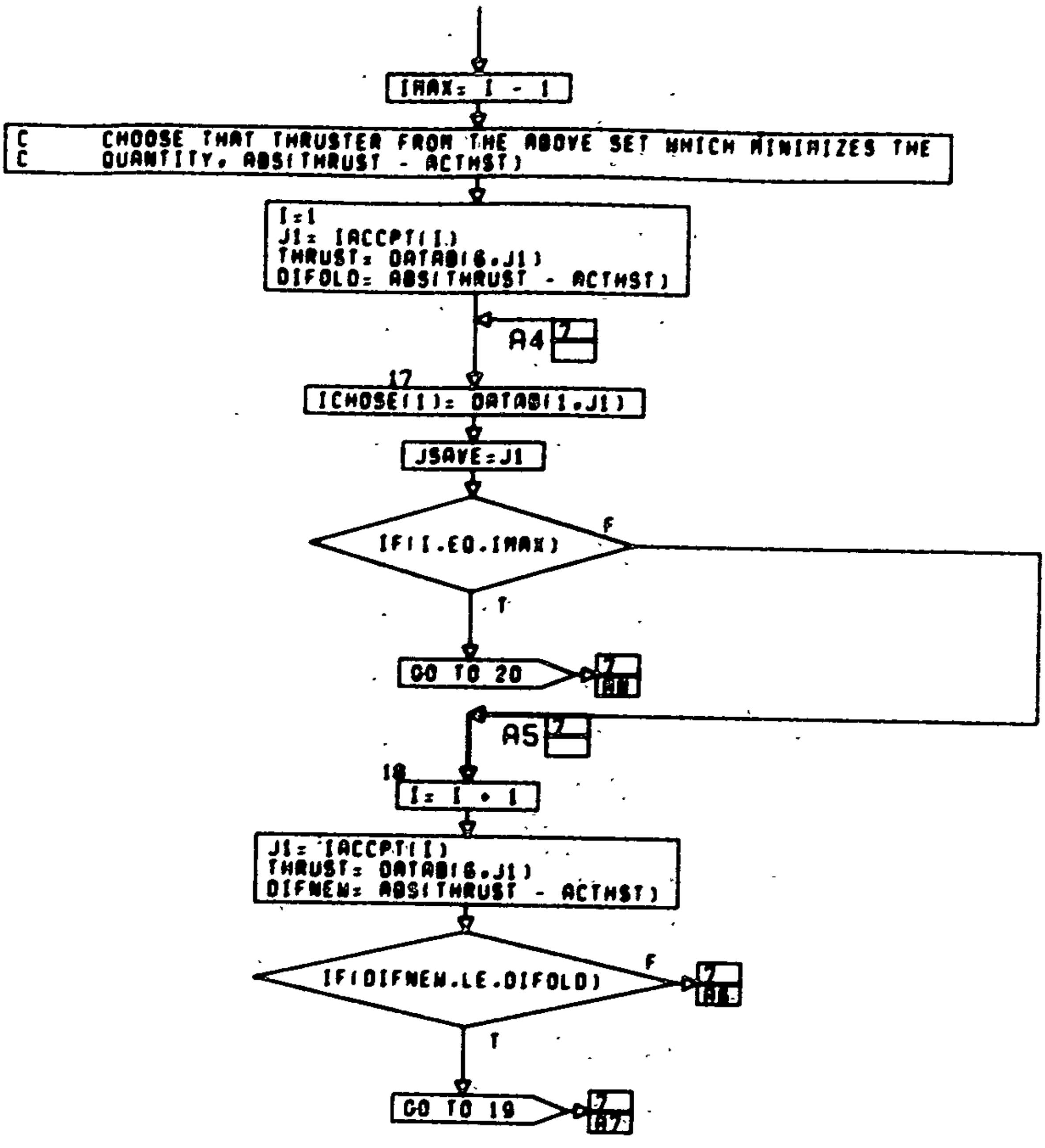
CONT. ON PG 4


IF(THRUST.GE.FMAX)
F
T
GO TO 12
IF(J1.EQ.J1E)
F
T
GO TO 11
J1= J1 + 1
GO TO 10
3
B3
C NO ACCEPTABLE THRUSTERS
11
ICHOSE(1)= -1
RETURN
C AT LEAST ONE ACCEPTABLE THRUSTER
12
CONTINUE
C SELECT PNEUMATIC ATTITUDE AND CONTROL THRUSTERS
C FIRST DETERMINE SET OF ALL THRUSTERS WHICH SATISFY THE INEQUALITY
C THRUST GE ACTHST

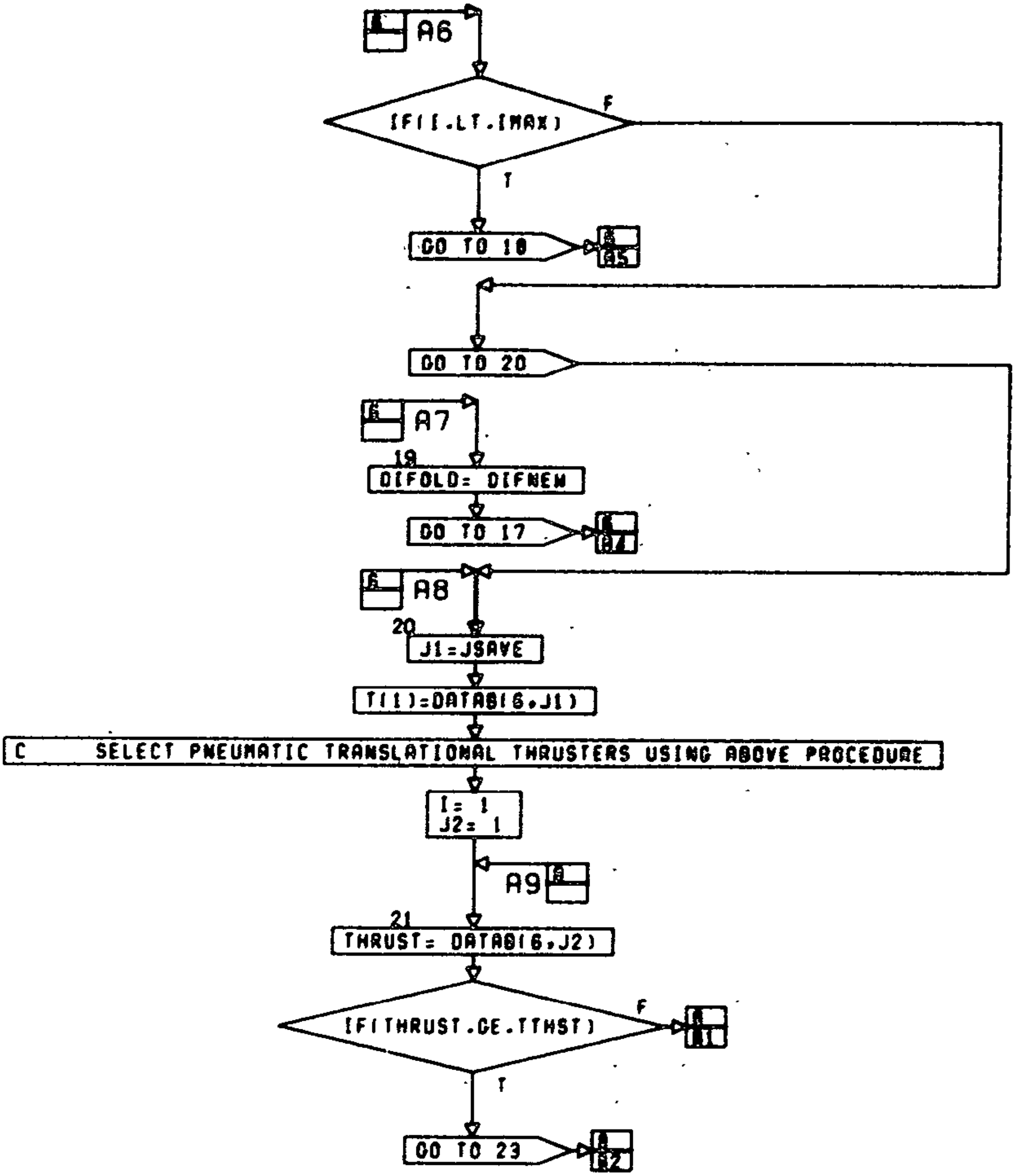
CONT. ON PG 5


I= 1
J1= 1
13
THRUST= DATAB(G,J1)
IF(THRUST.GE.ACTHST)
F
T
GO TO 15
14
IF(J1.EQ.J1E)
F
T
GO TO 16
J1= J1 + 1
GO TO 13
15
IACCPT(I)= J1
I= I + 1
GO TO 14
16
CONTINUE

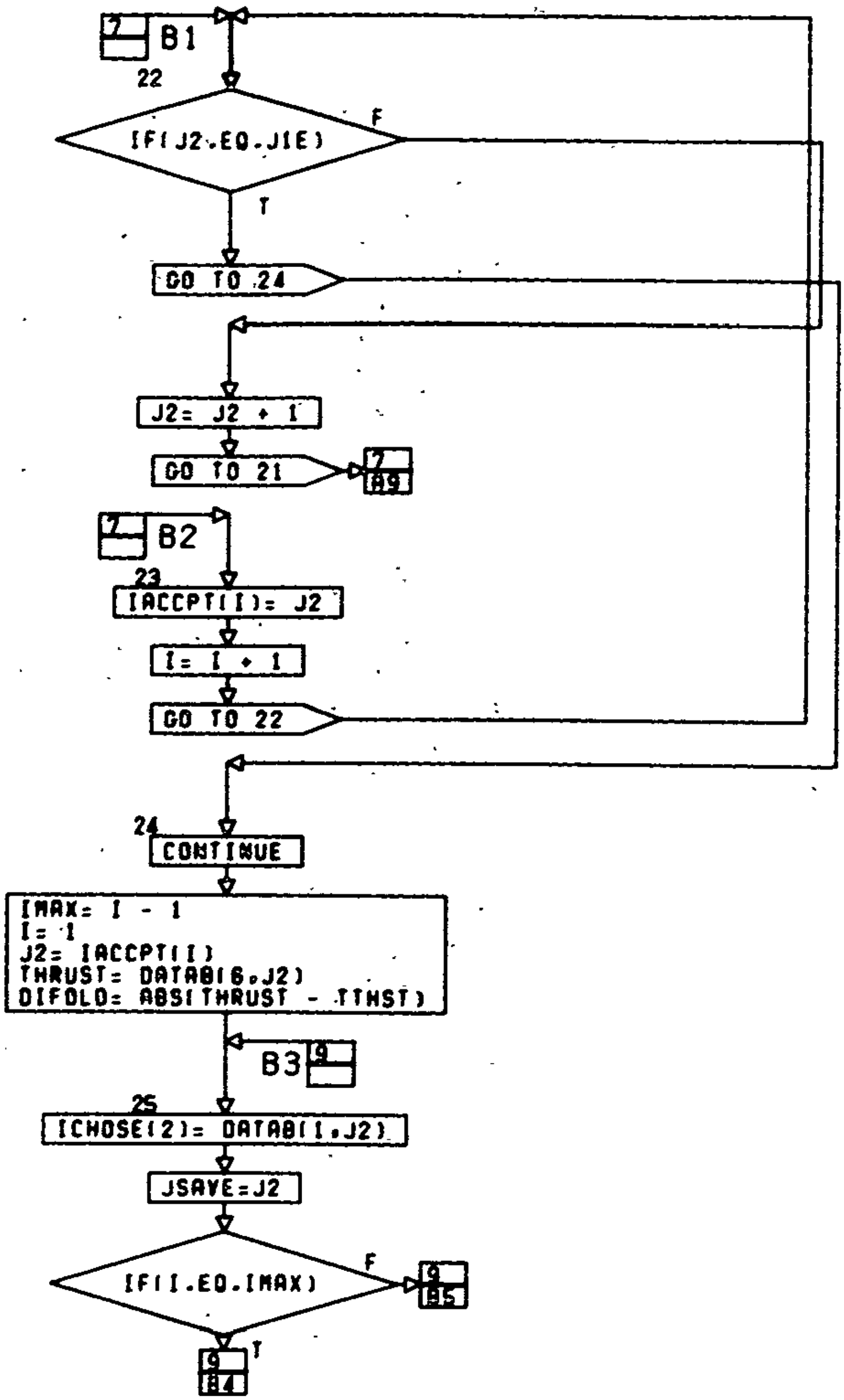
CONT. ON PG 6


IMAX= I - 1
C CHOOSE THAT THRUSTER FROM THE ABOVE SET WHICH MINIMIZES THE
C QUANTITY, ABS(THRUST - ACTHST)
I=1
J1= IACCPT(I)
THRUST= DATAB(6,J1)
DIFOLD= ABS(THRUST - ACTHST)
A4
7
17
ICHOSE(1)= DATAB(1,J1)
JSAVE=J1
IF(I.EQ.IMAX)
F
T
GO TO 20
7
A5
7
19
I= I + 1
J1= IACCPT(I)
THRUST= DATAB(6,J1)
DIFNEW= ABS(THRUST - ACTHST)
IF(DIFNEW.LE.DIFOLD)
F
7
T
GO TO 19
7
A7

CONT. ON PG 7

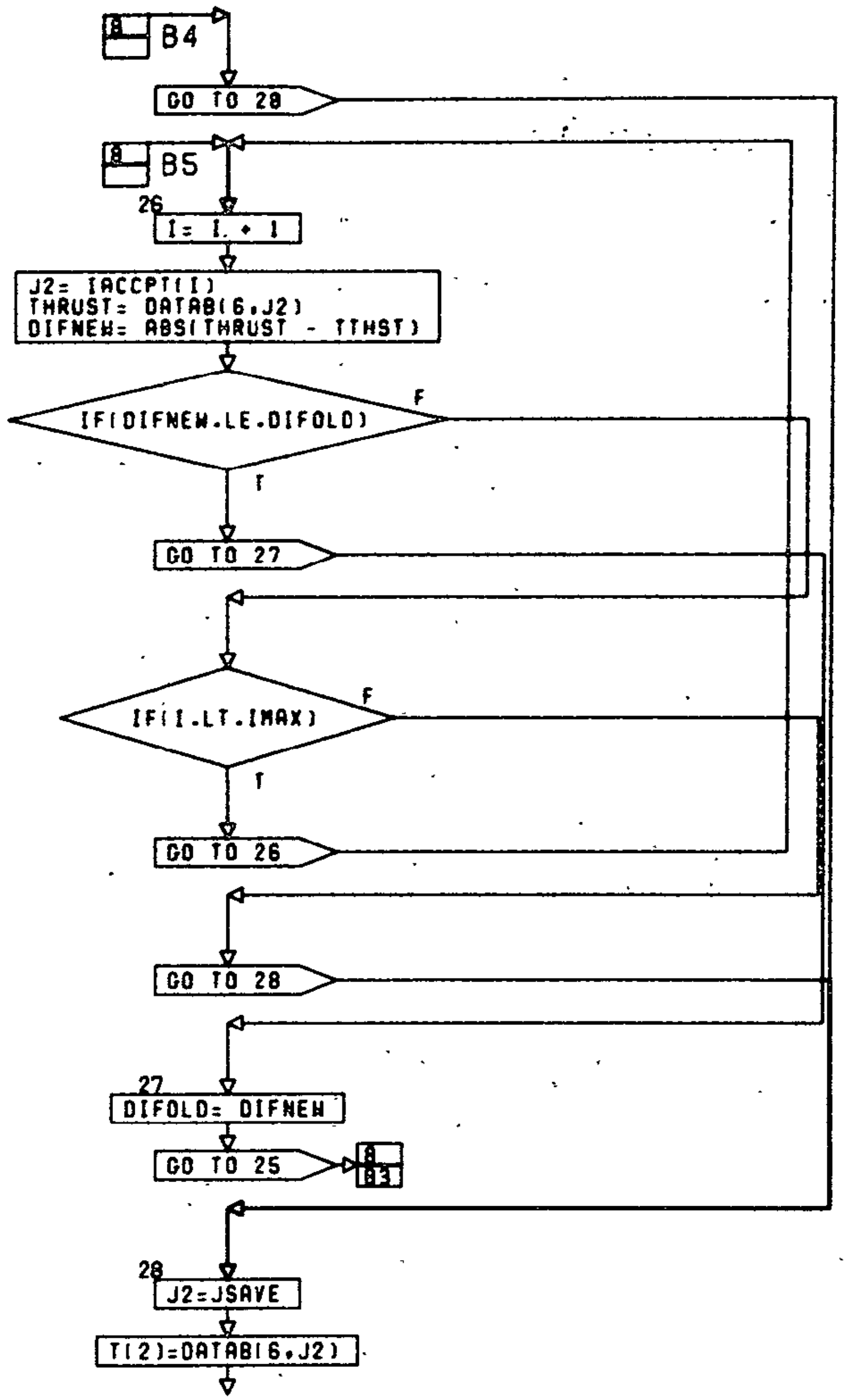

A6
IF(I.LT.IMAX)
F
T
GO TO 18
A5
GO TO 20
A7
19
DIFOLD= DIFNEW
GO TO 17
A8
20
J1=JSAVE
T(1)=DATAB(6,J1)
C SELECT PNEUMATIC TRANSLATIONAL THRUSTERS USING ABOVE PROCEDURE
I= 1
J2= 1
A9
21
THRUST= DATAB(6,J2)
IF(THRUST.GE.TTHST)
F
T
B1
GO TO 23
B2

CONT. ON PG 8

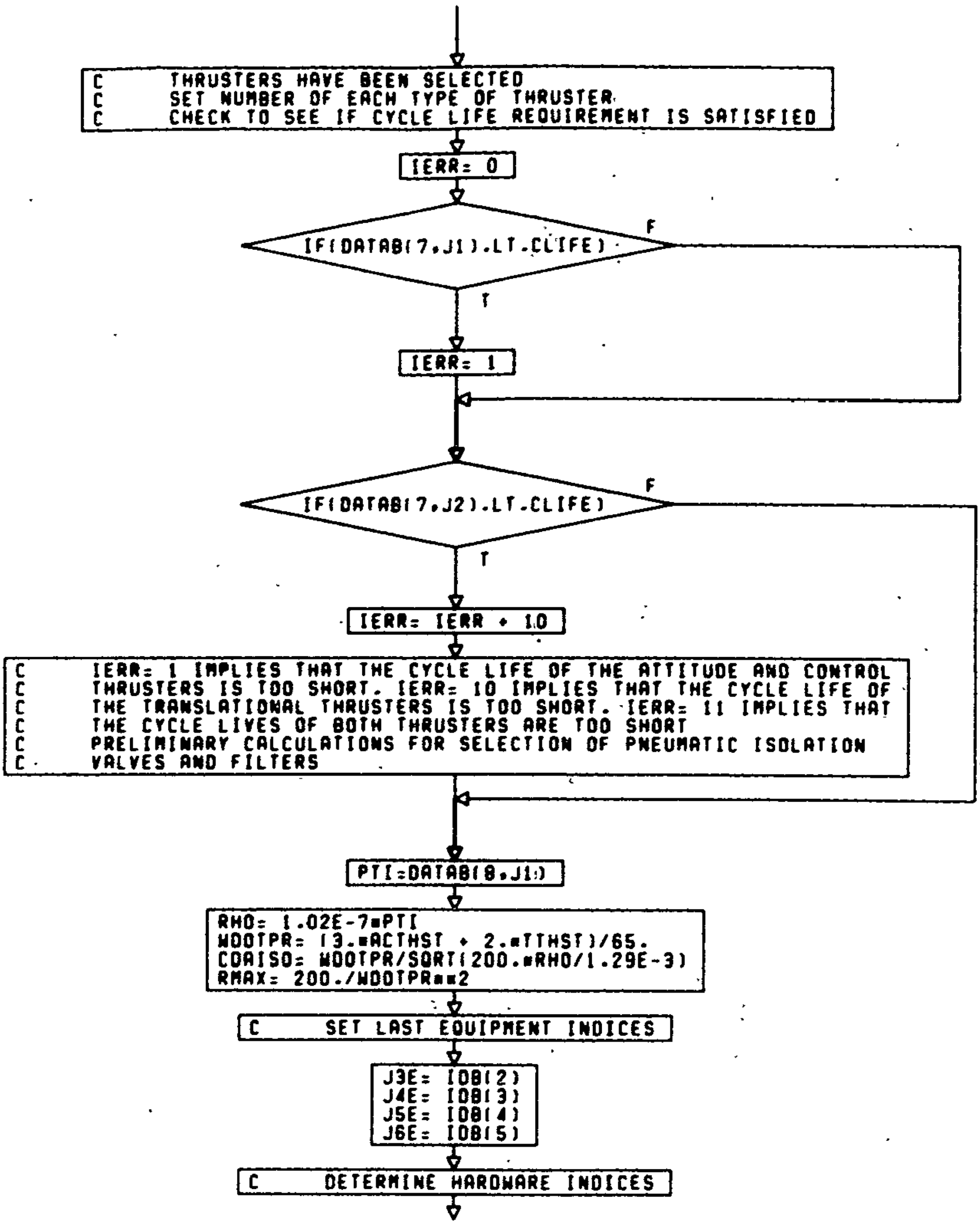


7
B1
22
IF(J2.EQ.J1E)
F
T
GO TO 24
J2= J2 + 1
GO TO 21
7
B9
7
B2
23
IACCPT(I)= J2
I= I + 1
GO TO 22
24
CONTINUE
IMAX= I - 1
I= 1
J2= IACCPT(I)
THRUST= DATAB(6,J2)
DIFOLD= ABS(THRUST - TTHST)
B3
9
25
ICHOSE(2)= DATAB(1,J2)
JSAVE=J2
IF(I.EQ.IMAX)
F
9
B5
T
9
B4

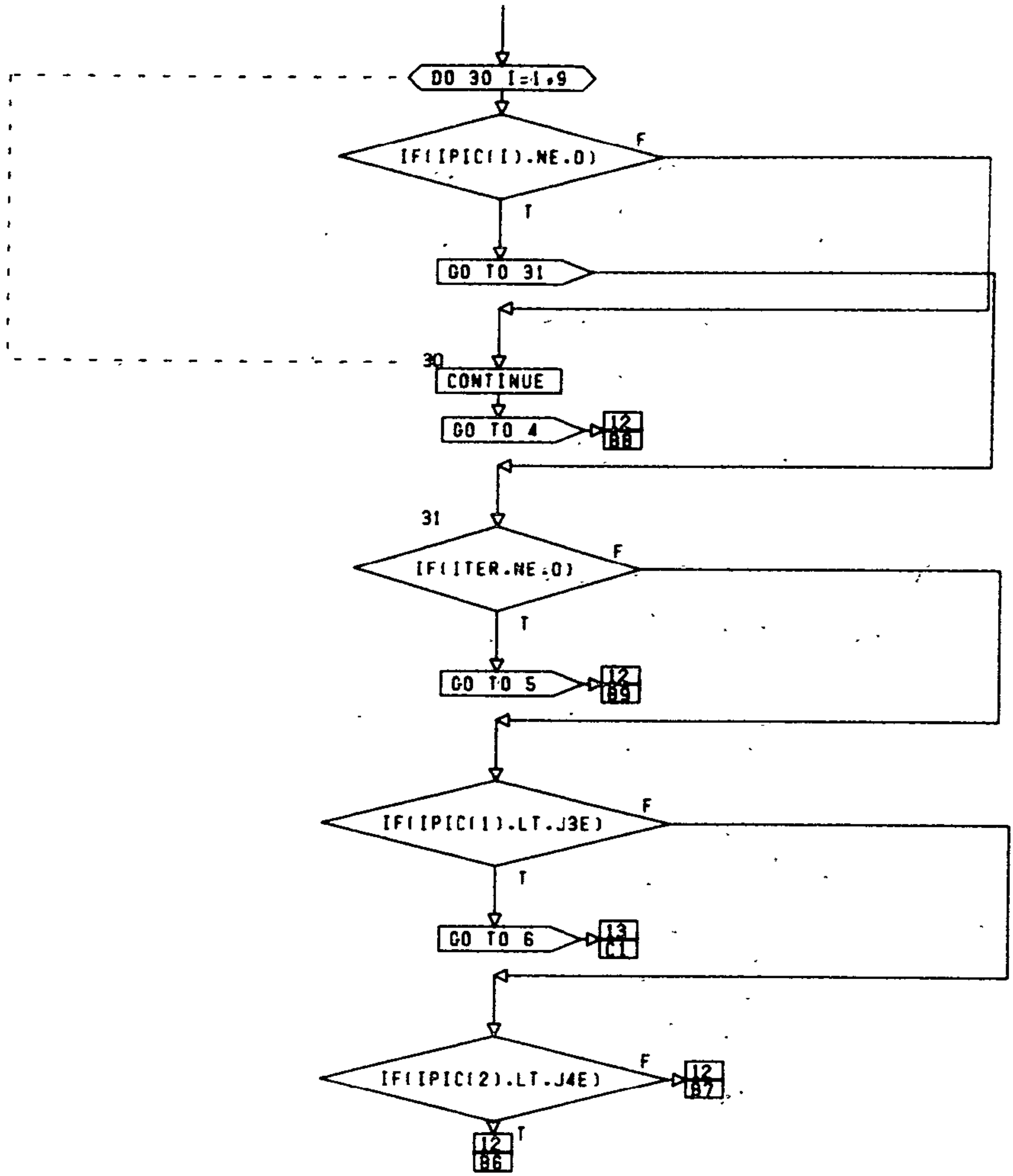
CONT. ON PG 9


B4
GO TO 28
B5
26
I= I + 1
J2= IACCPT(I)
THRUST= DATAB(6,J2)
DIFNEW= ABS(THRUST - TTHST)
IF(DIFNEW.LE.DIFOLD)
F
T
GO TO 27
IF(I.LT.IMAX)
F
T
GO TO 26
GO TO 28
27
DIFOLD= DIFNEW
GO TO 25
B3
28
J2=JSAVE
T(2)=DATAB(6,J2)

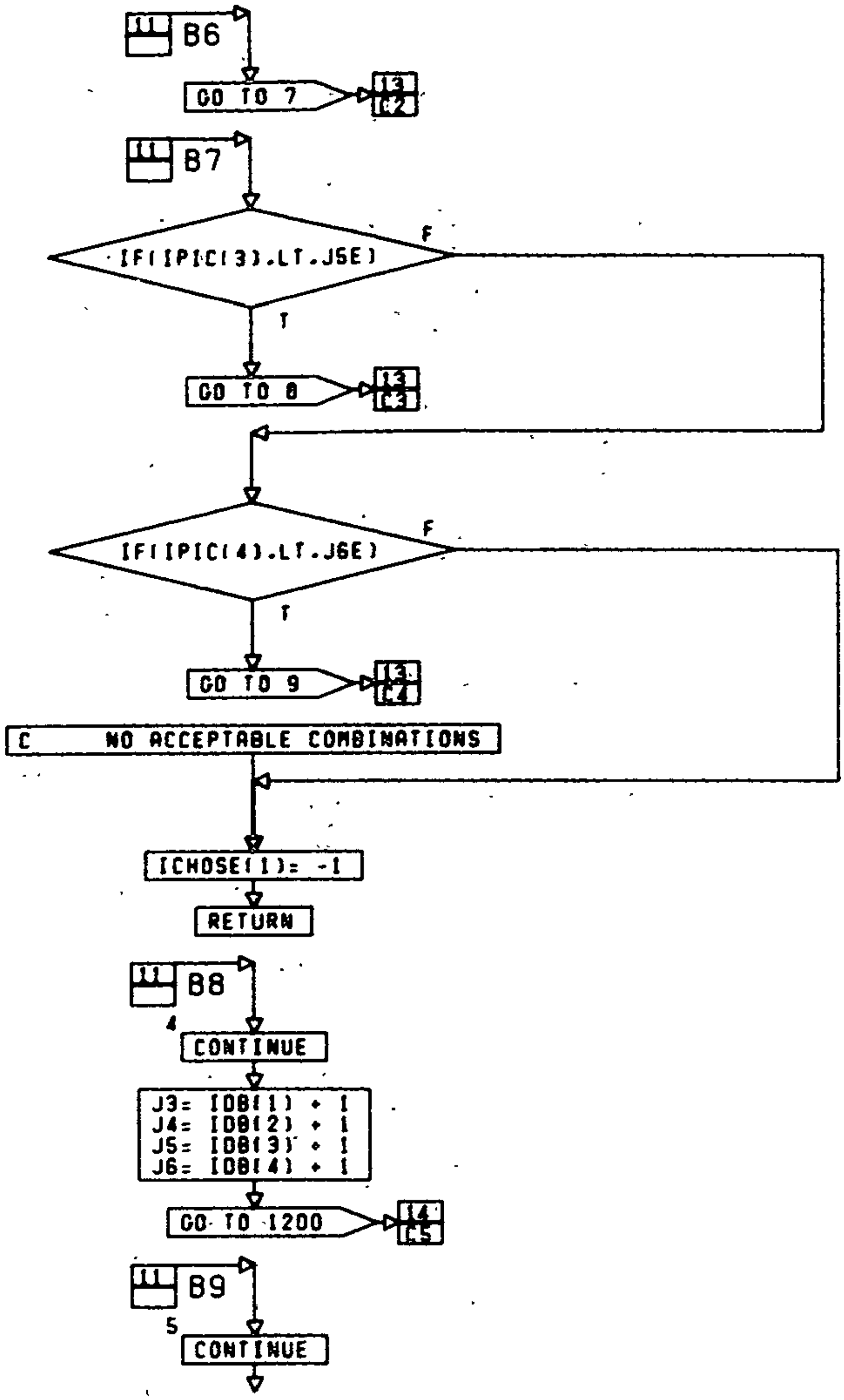
CONT. ON PG 10


C THRUSTERS HAVE BEEN SELECTED
C SET NUMBER OF EACH TYPE OF THRUSTER
C CHECK TO SEE IF CYCLE LIFE REQUIREMENT IS SATISFIED
IERR= 0
IF(DATAB(7,J1).LT.CLIFE)
F
T
IERR= 1
IF(DATAB(7,J2).LT.CLIFE)
F
T
IERR= IERR + 10
C IERR= 1 IMPLIES THAT THE CYCLE LIFE OF THE ATTITUDE AND CONTROL
C THRUSTERS IS TOO SHORT. IERR= 10 IMPLIES THAT THE CYCLE LIFE OF
C THE TRANSLATIONAL THRUSTERS IS TOO SHORT. IERR= 11 IMPLIES THAT
C THE CYCLE LIVES OF BOTH THRUSTERS ARE TOO SHORT
C PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC ISOLATION
C VALVES AND FILTERS
PTI=DATAB(8,J1)
RHO= 1.02E-7*PTI
WDOTPR= (3.*ACTHST + 2.*TTHST)/65.
CDAISO= WDOTPR/SQRT(200.*RHO/1.29E-3)
RMAX= 200./WDOTPR**2
C SET LAST EQUIPMENT INDICES
J3E= IDB(2)
J4E= IDB(3)
J5E= IDB(4)
J6E= IDB(5)
C DETERMINE HARDWARE INDICES

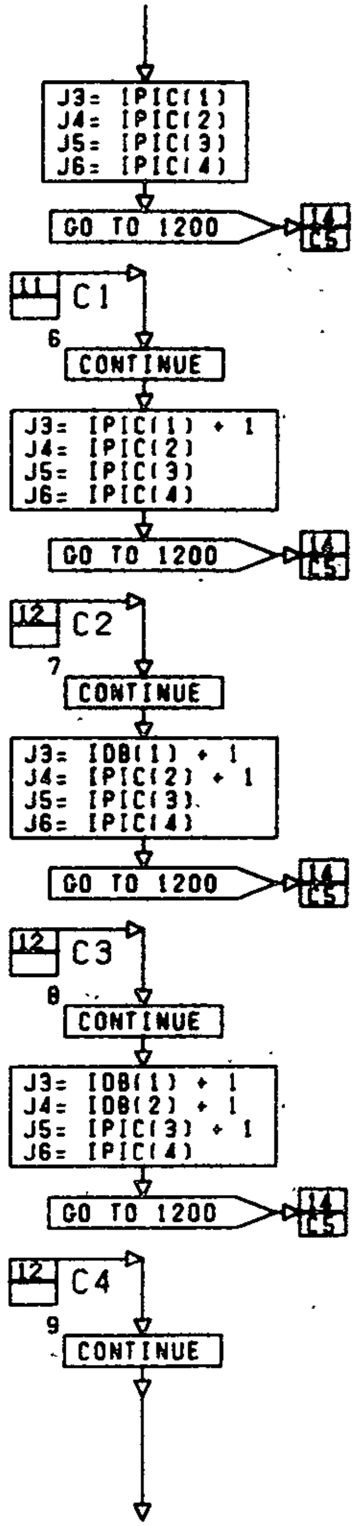
CONT. ON PG 11


DO 30 I=1,9
IF(IPIC(I).NE.0)
F
T
GO TO 31
30
CONTINUE
GO TO 4
12
B8
31
IF(ITER.NE.0)
F
T
GO TO 5
12
B9
IF(IPIC(1).LT.J3E)
F
T
GO TO 6
13
C1
IF(IPIC(2).LT.J4E)
F
12
B7
T
12
B6

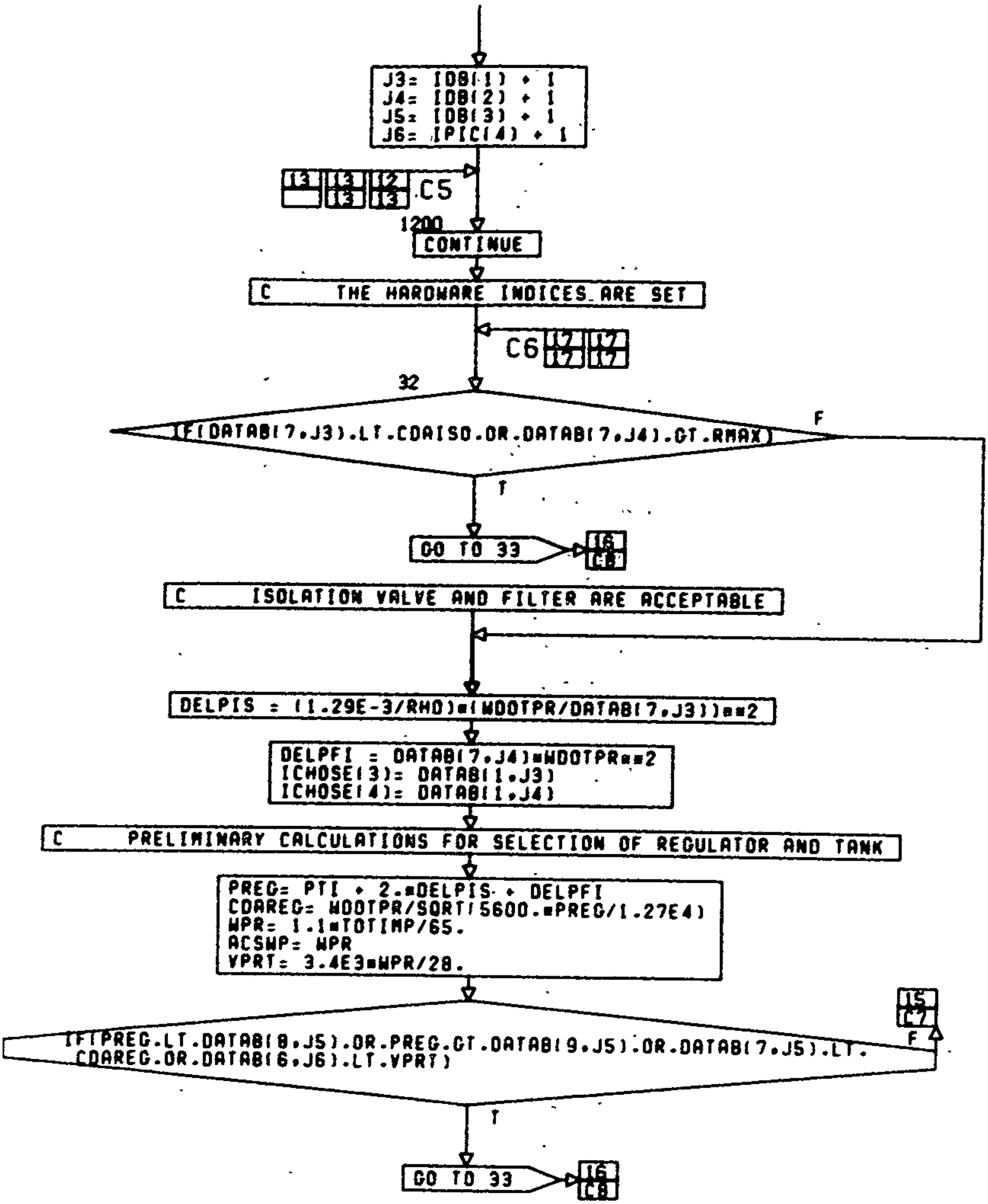
CONT. ON PG 12


11 B6
GO TO 7
13 C2
11 B7
IF(IPIC(3).LT.J5E)
F
T
GO TO 8
13 C3
IF(IPIC(4).LT.J6E)
F
T
GO TO 9
13 C4
C NO ACCEPTABLE COMBINATIONS
ICHOSE(1)= -1
RETURN
11 B8
4
CONTINUE
J3= IDB(1) + 1
J4= IDB(2) + 1
J5= IDB(3) + 1
J6= IDB(4) + 1
GO TO 1200
14 C5
11 B9
5
CONTINUE

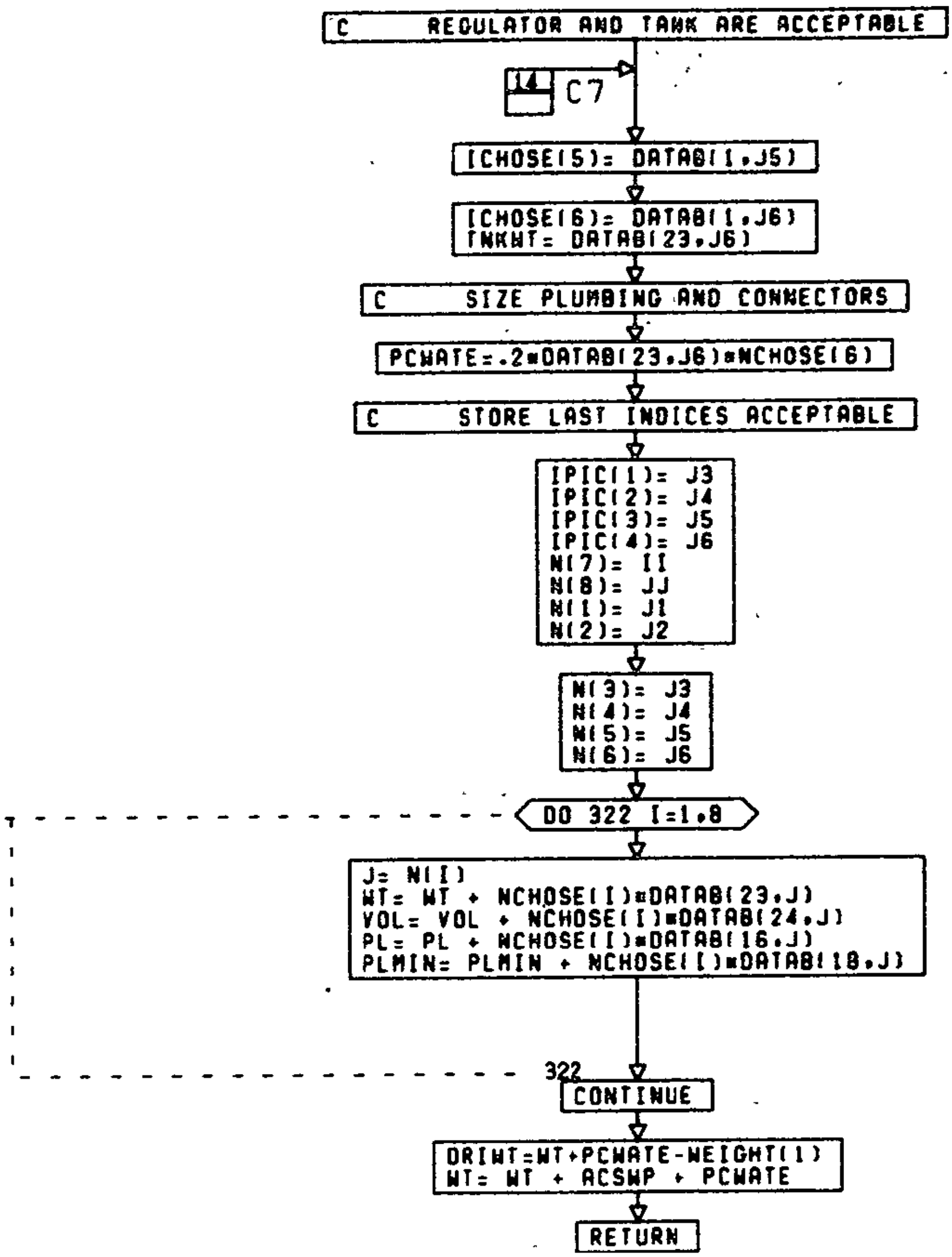
CONT. ON PG 13


J3= IPIC(1)
J4= IPIC(2)
J5= IPIC(3)
J6= IPIC(4)
GO TO 1200
14
C5
11
C1
6
CONTINUE
J3= IPIC(1) + 1
J4= IPIC(2)
J5= IPIC(3)
J6= IPIC(4)
GO TO 1200
14
C5
12
C2
7
CONTINUE
J3= IDB(1) + 1
J4= IPIC(2) + 1
J5= IPIC(3)
J6= IPIC(4)
GO TO 1200
14
C5
12
C3
8
CONTINUE
J3= IDB(1) + 1
J4= IDB(2) + 1
J5= IPIC(3) + 1
J6= IPIC(4)
GO TO 1200
14
C5
12
C4
9
CONTINUE

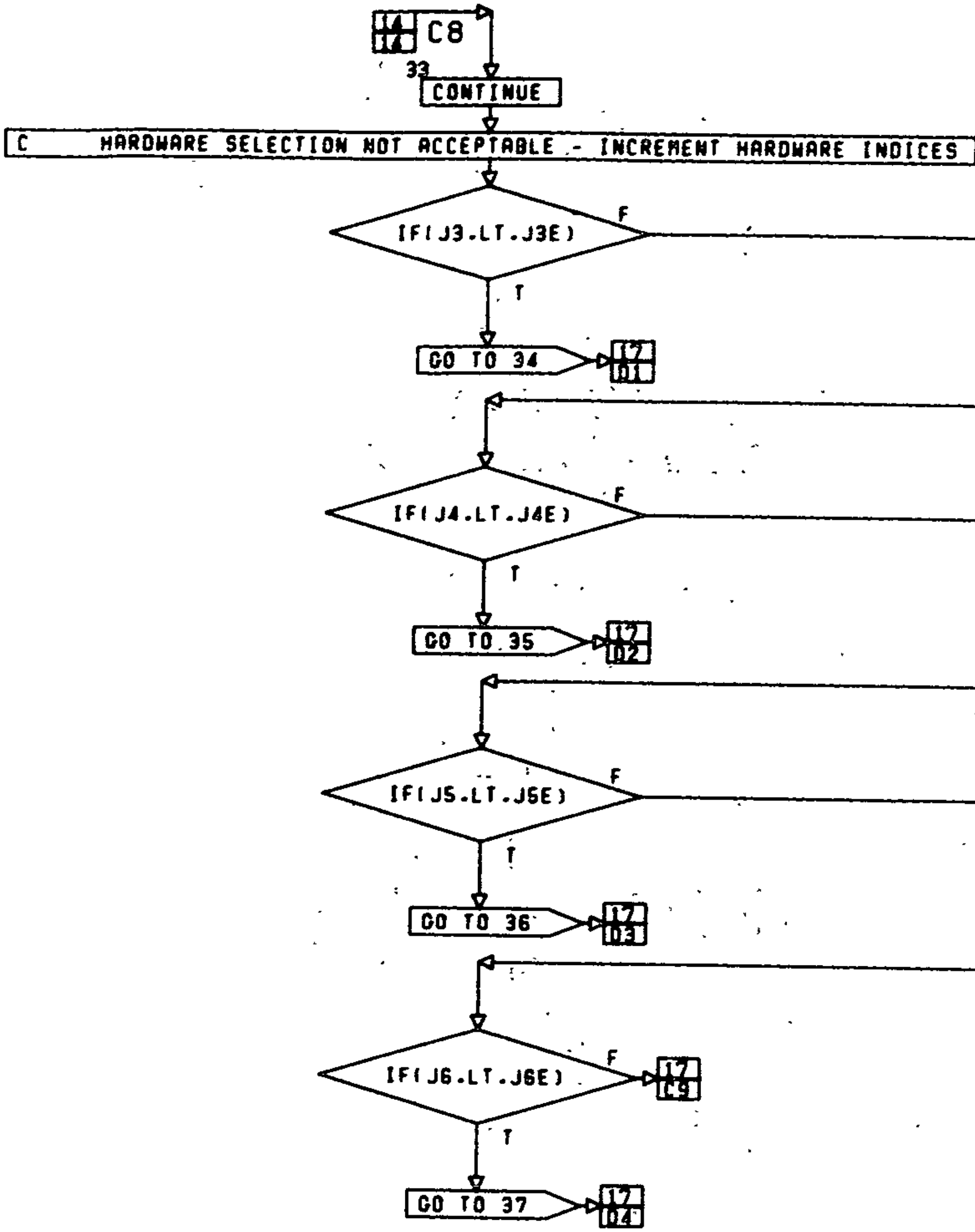
CONT. ON PG 14


J3= IDB(1) + 1
J4= IDB(2) + 1
J5= IDB(3) + 1
J6= IPIC(4) + 1
C5
1200
CONTINUE
C THE HARDWARE INDICES ARE SET
C6
32
IF(DATAB(7,J3).LT.CDAISO.OR.DATAB(7,J4).GT.RMAX)
F
T
GO TO 33
C ISOLATION VALVE AND FILTER ARE ACCEPTABLE
DELPIS = (1.29E-3/RHO)*(WDOTPR/DATAB(7,J3))**2
DELPFI = DATAB(7,J4)*WDOTPR**2
ICHOSE(3)= DATAB(1,J3)
ICHOSE(4)= DATAB(1,J4)
C PRELIMINARY CALCULATIONS FOR SELECTION OF REGULATOR AND TANK
PREG= PTI + 2.*DELPIS + DELPFI
CDAREG= WDOTPR/SQRT(5600.*PREG/1.27E4)
WPR= 1.1*TOTIMP/65.
ACSWP= WPR
VPRT= 3.4E3*WPR/28.
IF(PREG.LT.DATAB(8,J5).OR.PREG.GT.DATAB(9,J5).OR.DATAB(7,J5).LT.
CDAREG.OR.DATAB(6,J6).LT.VPRT)
F
T
GO TO 33
15
C7
16
C8

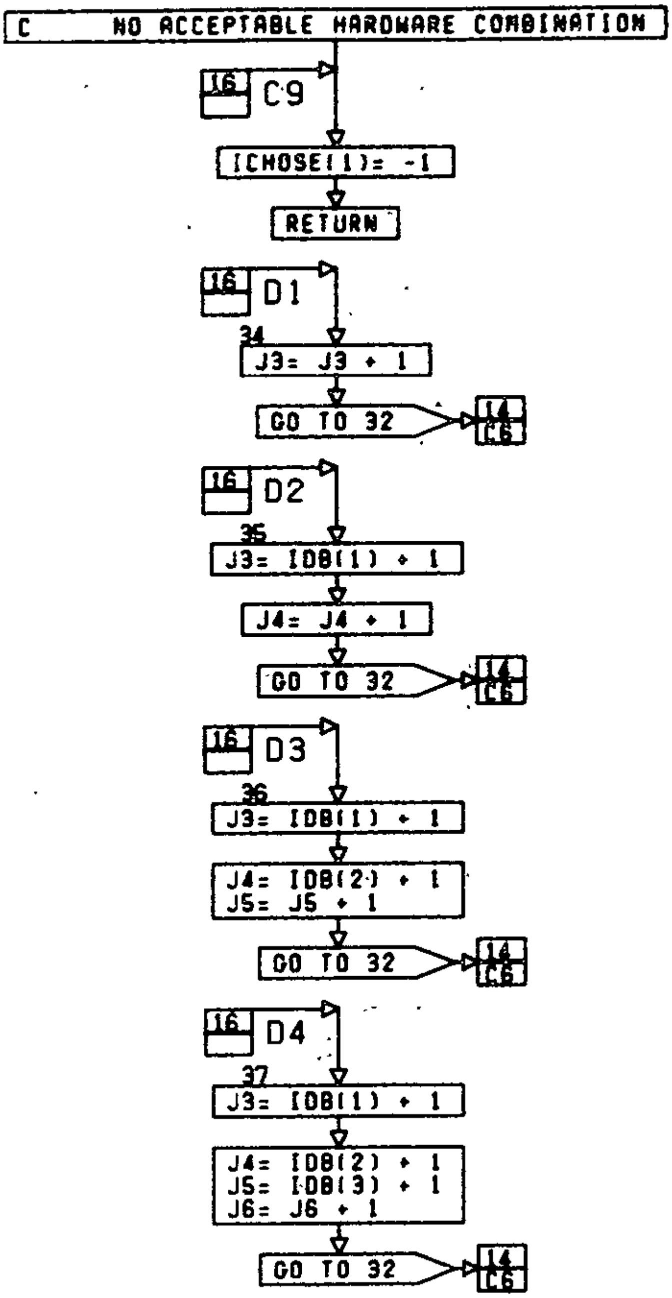
CONT. ON PG 15


C REGULATOR AND TANK ARE ACCEPTABLE
14
C7
ICHOSE(5)= DATAB(1,J5)
ICHOSE(6)= DATAB(1,J6)
TNKWT= DATAB(23,J6)
C SIZE PLUMBING AND CONNECTORS
PCWATE=.2*DATAB(23,J6)*NCHOSE(6)
C STORE LAST INDICES ACCEPTABLE
IPIC(1)= J3
IPIC(2)= J4
IPIC(3)= J5
IPIC(4)= J6
N(7)= II
N(8)= JJ
N(1)= J1
N(2)= J2
N(3)= J3
N(4)= J4
N(5)= J5
N(6)= J6
DO 322 I=1,8
J= N(I)
WT= WT + NCHOSE(I)*DATAB(23,J)
VOL= VOL + NCHOSE(I)*DATAB(24,J)
PL= PL + NCHOSE(I)*DATAB(16,J)
PLMIN= PLMIN + NCHOSE(I)*DATAB(18,J)
322
CONTINUE
DRIWT=WT+PCWATE-WEIGHT(1)
WT= WT + ACSWP + PCWATE
RETURN

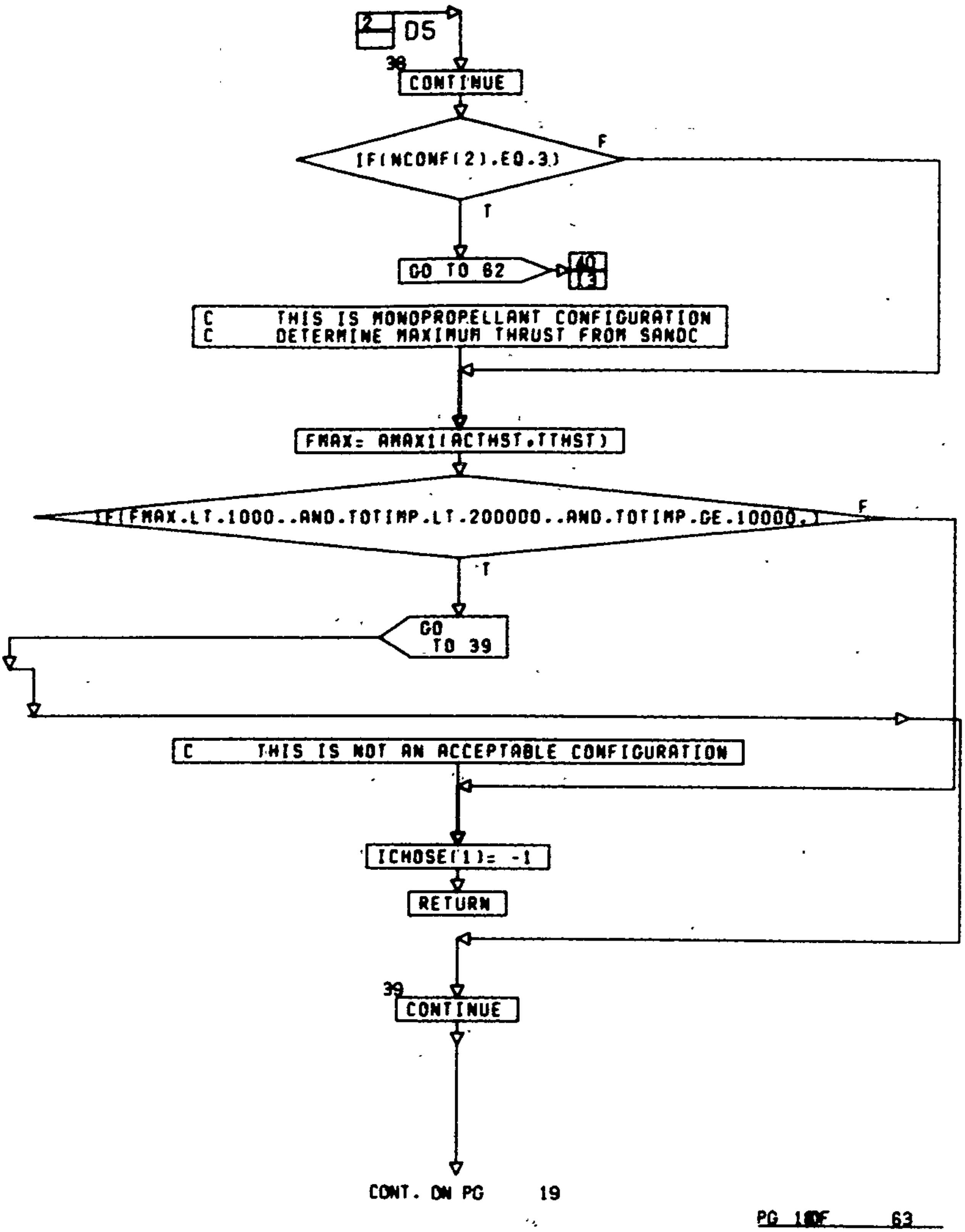
CONT. ON PG 16

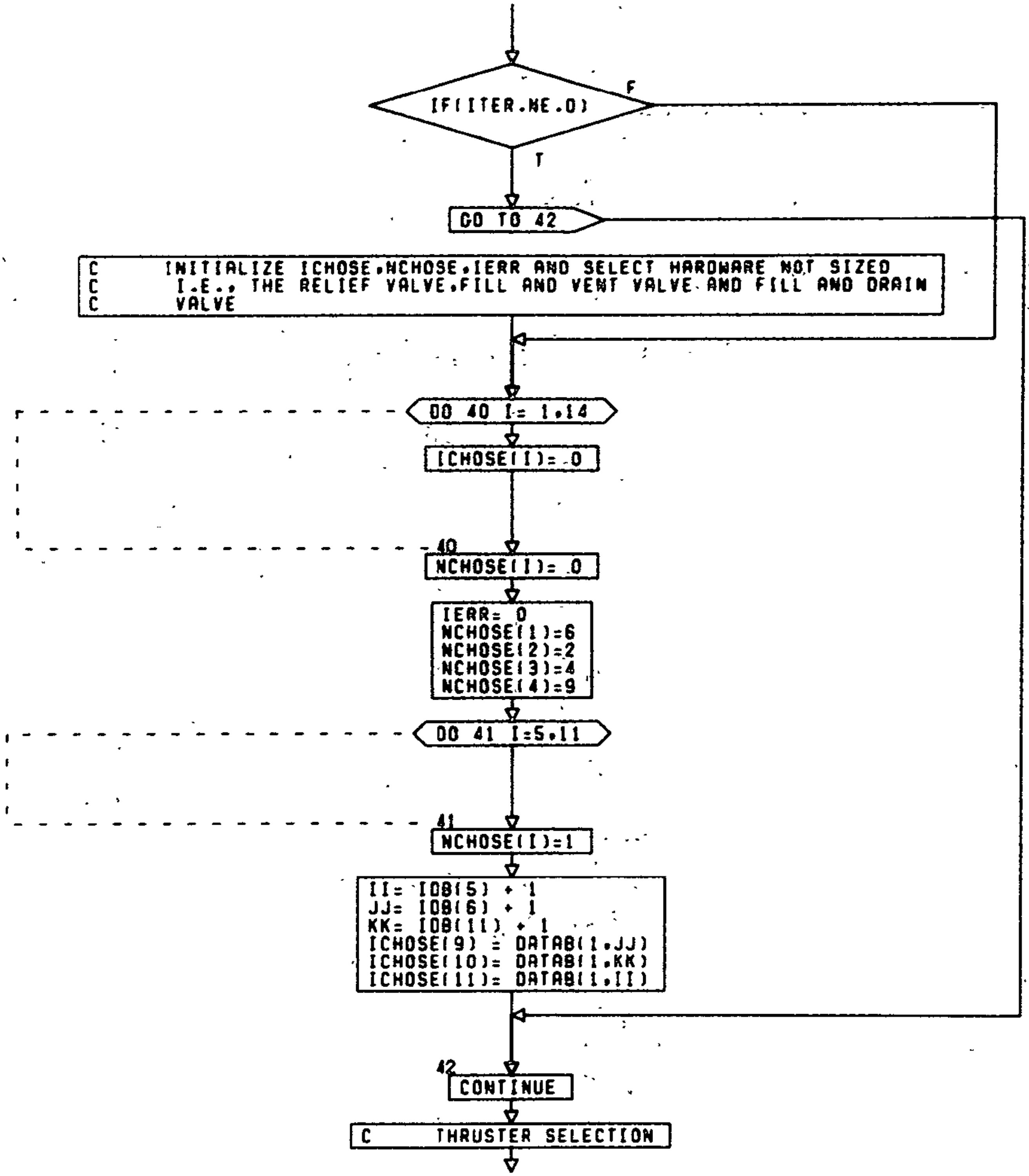

14
14
C8
33
CONTINUE
C HARDWARE SELECTION NOT ACCEPTABLE - INCREMENT HARDWARE INDICES
IF(J3.LT.J3E)
F
T
GO TO 34
17
D1
IF(J4.LT.J4E)
F
T
GO TO 35
17
D2
IF(J5.LT.J5E)
F
T
GO TO 36
17
D3
IF(J6.LT.J6E)
F
17
C9
T
GO TO 37
17
D4

CONT. ON PG 17

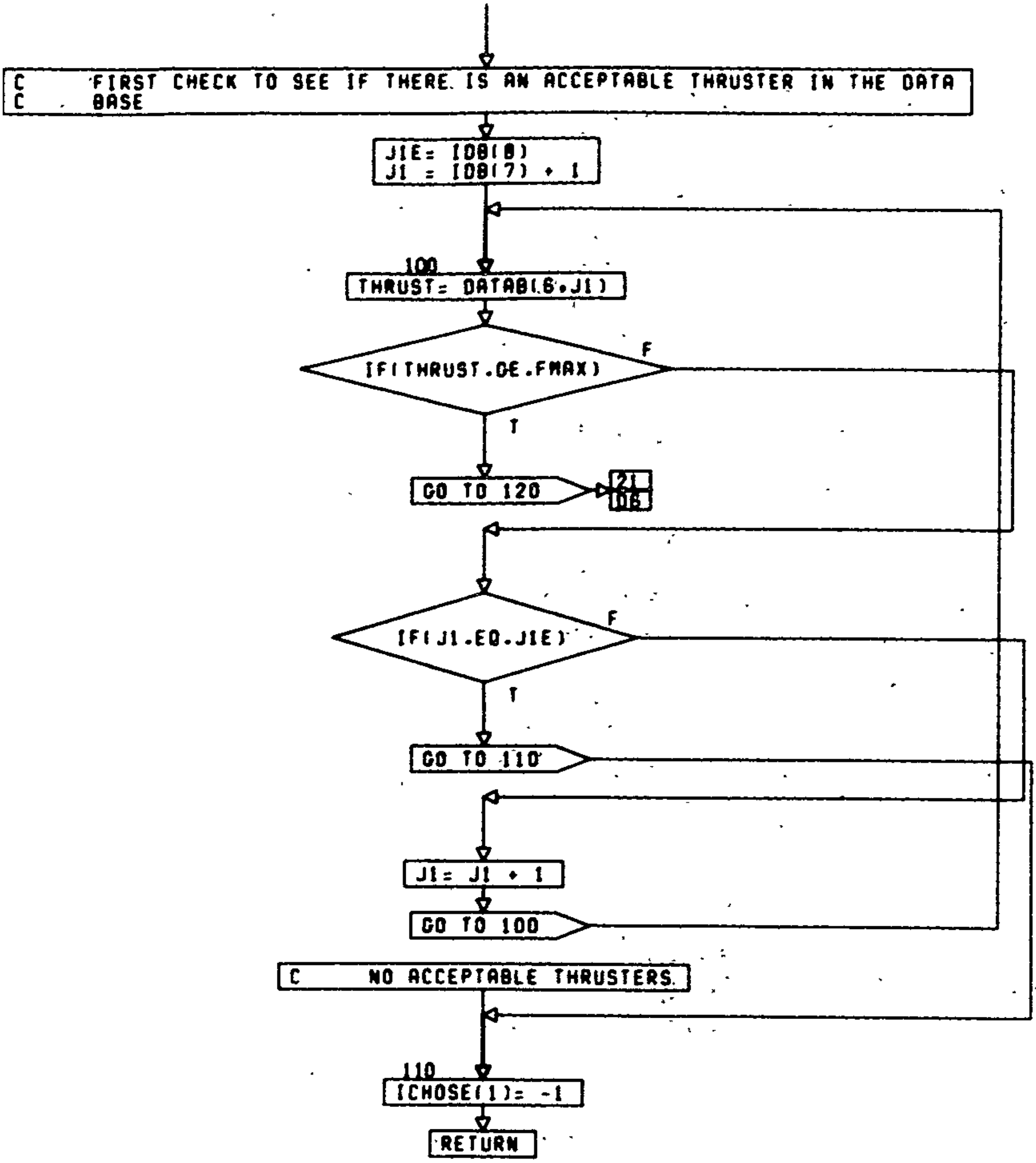

C NO ACCEPTABLE HARDWARE COMBINATION
16 C9
ICHOSE(1)= -1
RETURN
16 D1
34
J3= J3 + 1
GO TO 32
14 C6
16 D2
35
J3= IDB(1) + 1
J4= J4 + 1
GO TO 32
14 C6
16 D3
36
J3= IDB(1) + 1
J4= IDB(2) + 1
J5= J5 + 1
GO TO 32
14 C6
16 D4
37
J3= IDB(1) + 1
J4= IDB(2) + 1
J5= IDB(3) + 1
J6= J6 + 1
GO TO 32
14 C6

CONT. ON PG 18

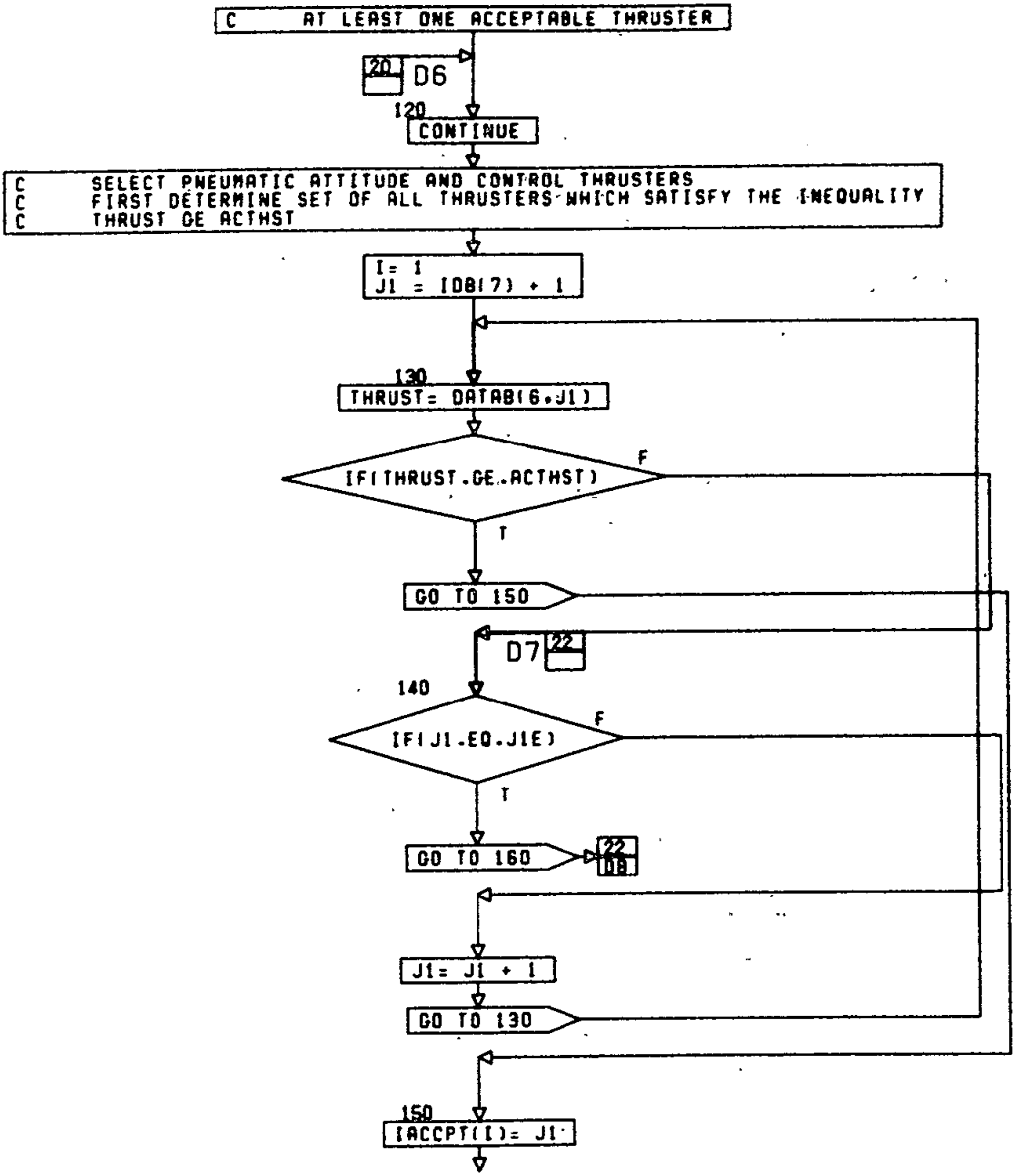

2
D5
38
CONTINUE
IF(NCONF(2).EQ.3)
F
T
GO TO 62
40
I3
C THIS IS MONOPROPELLANT CONFIGURATION
C DETERMINE MAXIMUM THRUST FROM SANDC
FMAX= AMAX1(ACTHST,TTHST)
IF(FMAX.LT.1000..AND.TOTIMP.LT.200000..AND.TOTIMP.GE.10000.)
F
T
GO TO 39
C THIS IS NOT AN ACCEPTABLE CONFIGURATION
ICHOSE(1)= -1
RETURN
39
CONTINUE
CONT. ON PG 19
PG 18OF 63


IF(ITER.NE.0)
F
T
GO TO 42
C INITIALIZE ICHOSE,NCHOSE,IERR AND SELECT HARDWARE NOT SIZED
C I.E., THE RELIEF VALVE,FILL AND VENT VALVE AND FILL AND DRAIN
C VALVE
DO 40 I= 1,14
ICHOSE(I)= 0
40
NCHOSE(I)= 0
IERR= 0
NCHOSE(1)=6
NCHOSE(2)=2
NCHOSE(3)=4
NCHOSE(4)=9
DO 41 I=5,11
41
NCHOSE(I)=1
II= IDB(5) + 1
JJ= IDB(6) + 1
KK= IDB(11) + 1
ICHOSE(9) = DATAB(1,JJ)
ICHOSE(10)= DATAB(1,KK)
ICHOSE(11)= DATAB(1,II)
42
CONTINUE
C THRUSTER SELECTION

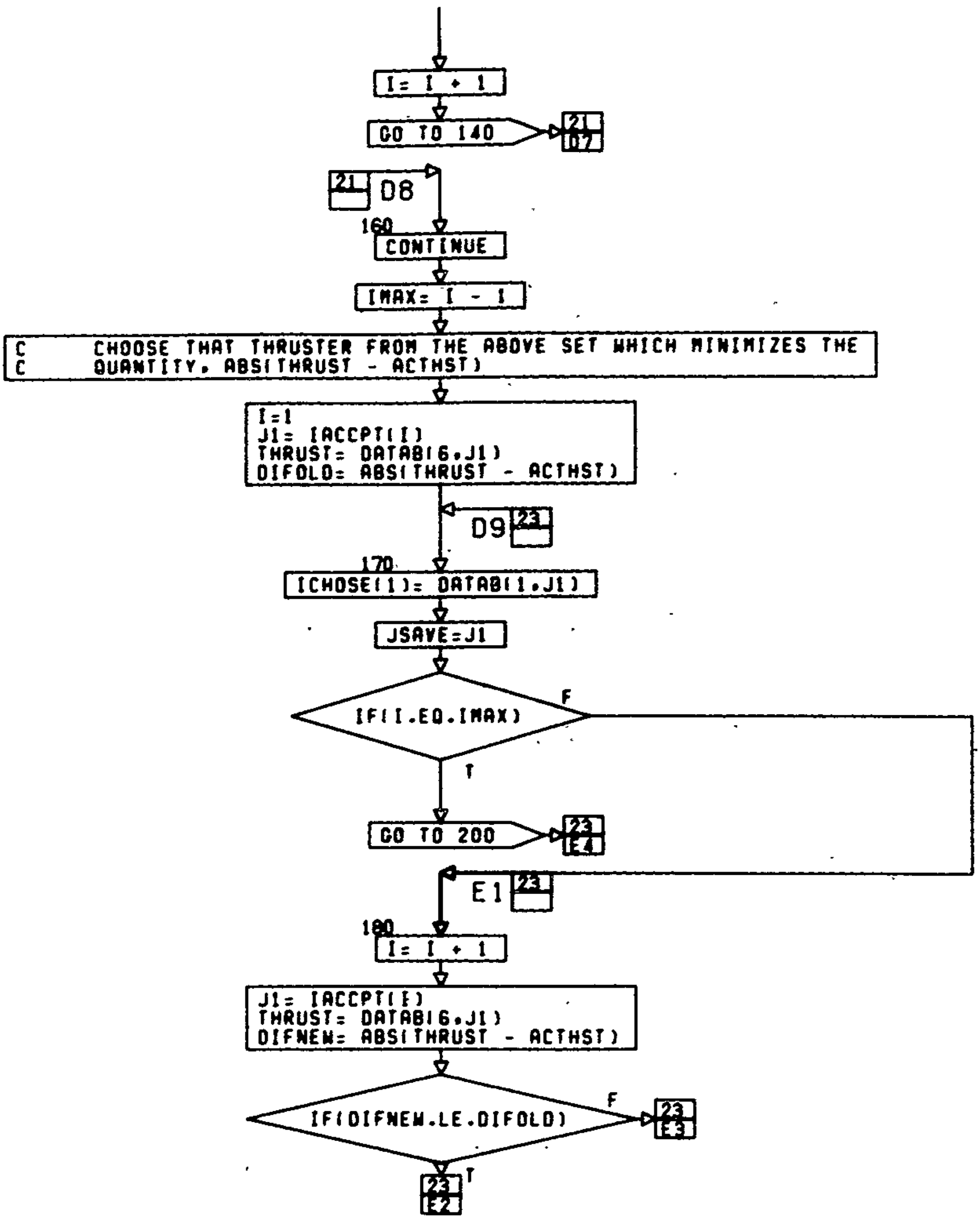
CONT. ON PG .20


C FIRST CHECK TO SEE IF THERE IS AN ACCEPTABLE THRUSTER IN THE DATA
C BASE
JIE= IDB(8)
J1 = IDB(7) + 1
100
THRUST= DATAB(6,J1)
IF(THRUST.GE.FMAX)
F
T
GO TO 120
21
D6
IF(J1.EQ.JIE)
F
T
GO TO 110
J1= J1 + 1
GO TO 100
C NO ACCEPTABLE THRUSTERS.
110
ICHOSE(1)= -1
RETURN

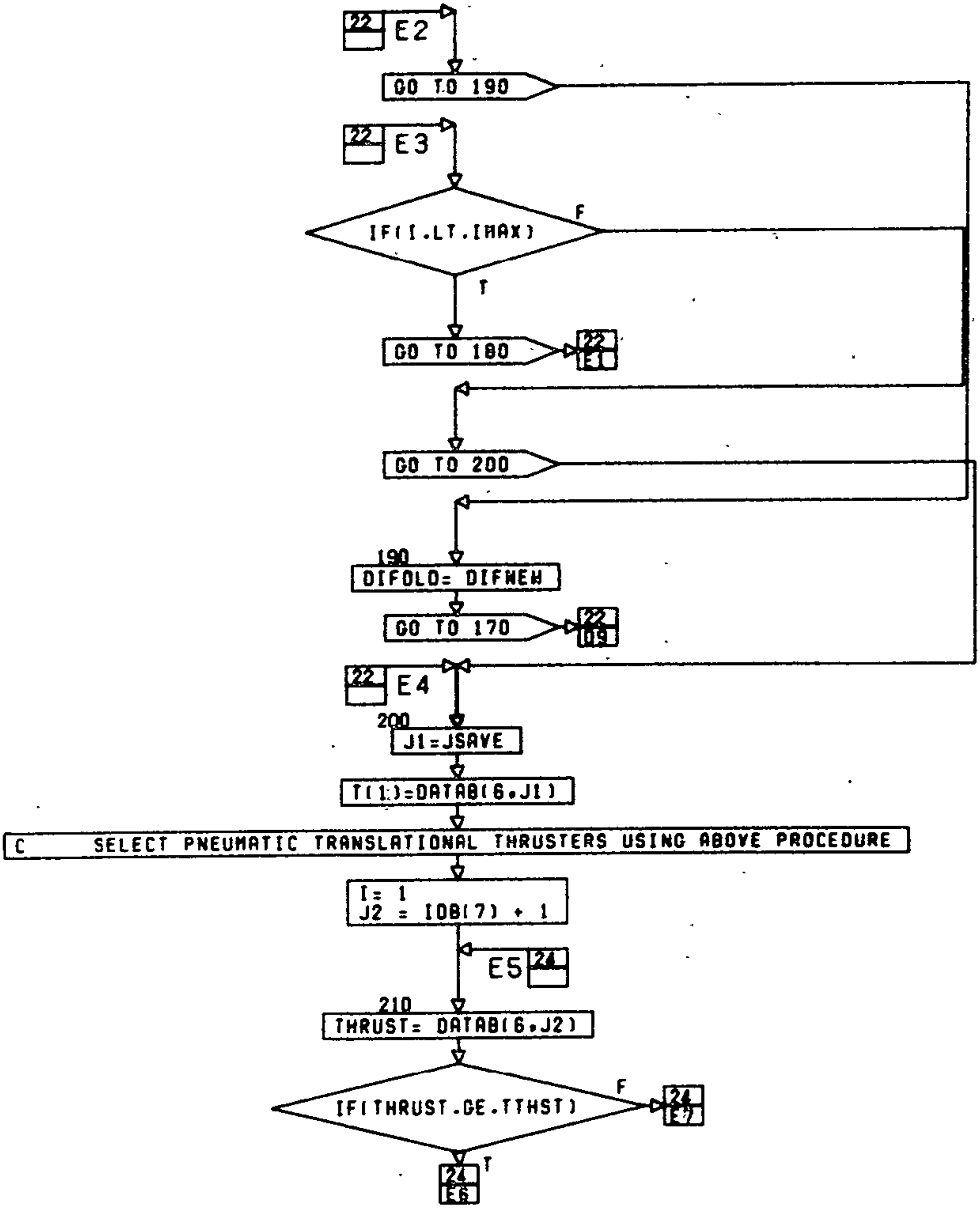
CONT. ON PG 21


C AT LEAST ONE ACCEPTABLE THRUSTER
20
D6
120
CONTINUE
C SELECT PNEUMATIC ATTITUDE AND CONTROL THRUSTERS
C FIRST DETERMINE SET OF ALL THRUSTERS WHICH SATISFY THE INEQUALITY
C THRUST GE ACTHST
I= 1
J1 = IDB(7) + 1
130
THRUST= DATAB(6,J1)
IF(THRUST.GE.ACTHST)
F
T
GO TO 150
D7
22
140
IF(J1.EQ.J1E)
F
T
GO TO 160
22
D8
J1= J1 + 1
GO TO 130
150
IACCPT(I)= J1

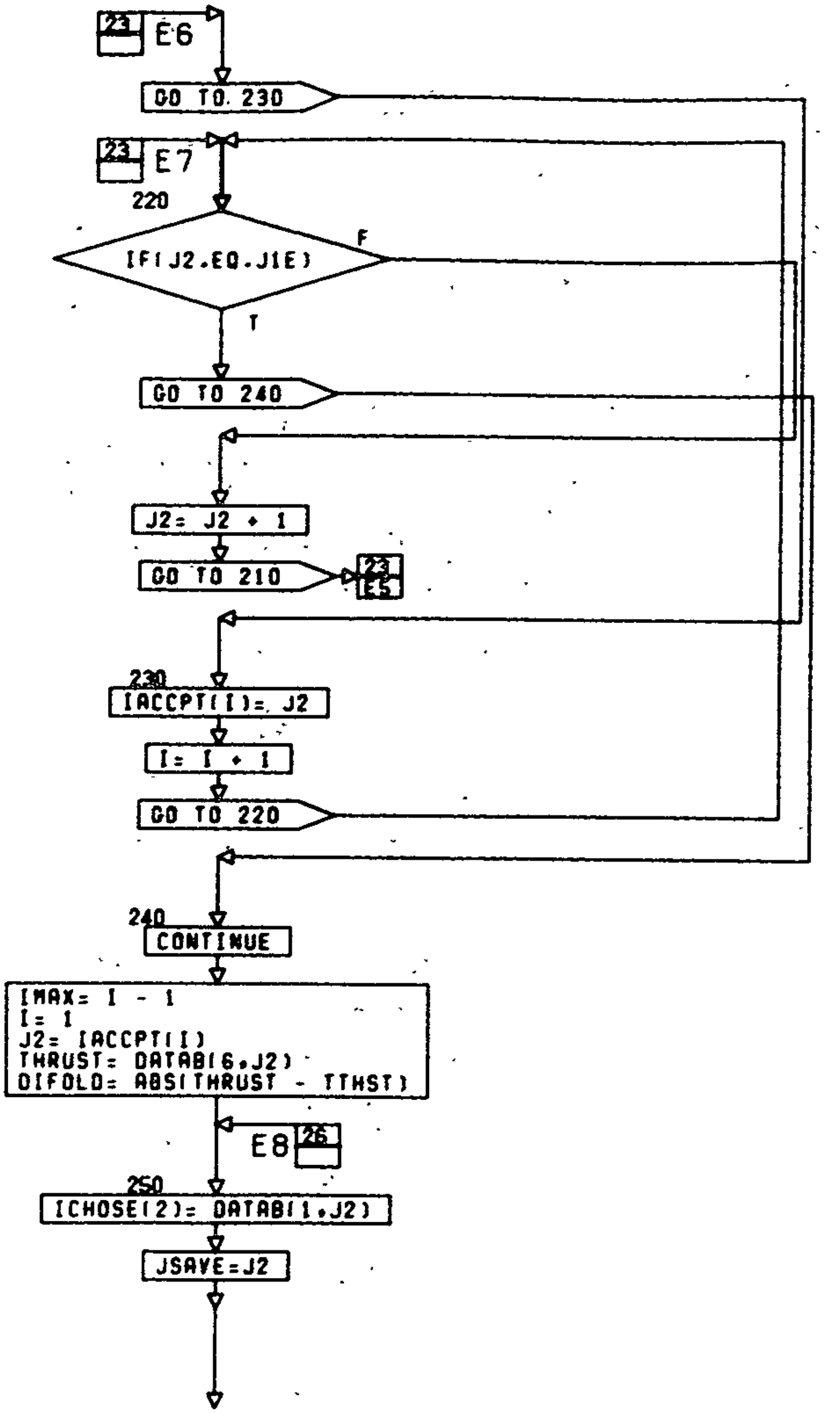
CONT. ON PG 22


I= I + 1
GO TO 140
21
D7
21
D8
160
CONTINUE
IMAX= I - 1
C CHOOSE THAT THRUSTER FROM THE ABOVE SET WHICH MINIMIZES THE
C QUANTITY, ABS(THRUST - ACTHST)
I=1
J1= IACCPT(I)
THRUST= DATAB(6,J1)
DIFOLD= ABS(THRUST - ACTHST)
D9
23
170
ICHOSE(1)= DATAB(1,J1)
JSAVE=J1
IF(I.EQ.IMAX)
F
T
GO TO 200
23
E4
E1
23
180
I= I + 1
J1= IACCPT(I)
THRUST= DATAB(6,J1)
DIFNEW= ABS(THRUST - ACTHST)
IF(DIFNEW.LE.DIFOLD)
F
23
E3
T
23
E2

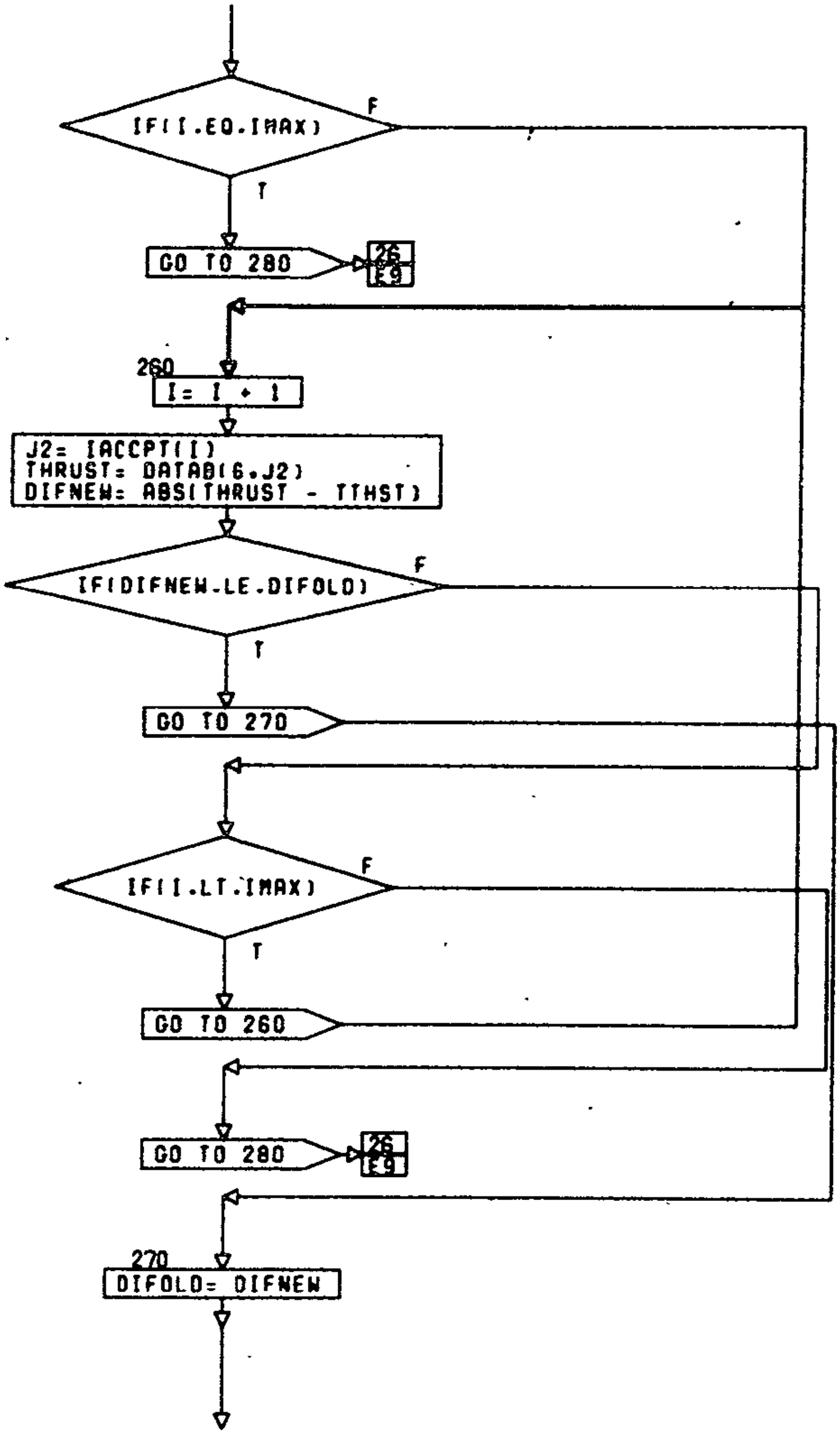
CONT. ON PG 23


22 E2
GO TO 190
22 E3
IF(I.LT.IMAX)
F
T
GO TO 180
22 E1
GO TO 200
190
DIFOLD= DIFNEW
GO TO 170
22 109
22 E4
200
J1=JSAVE
T(1)=DATAB(6,J1)
C SELECT PNEUMATIC TRANSLATIONAL THRUSTERS USING ABOVE PROCEDURE
I= 1
J2 = IDB(7) + 1
E5 24
210
THRUST= DATAB(6,J2)
IF(THRUST.GE.TTHST)
F
24 E7
T
24 E6

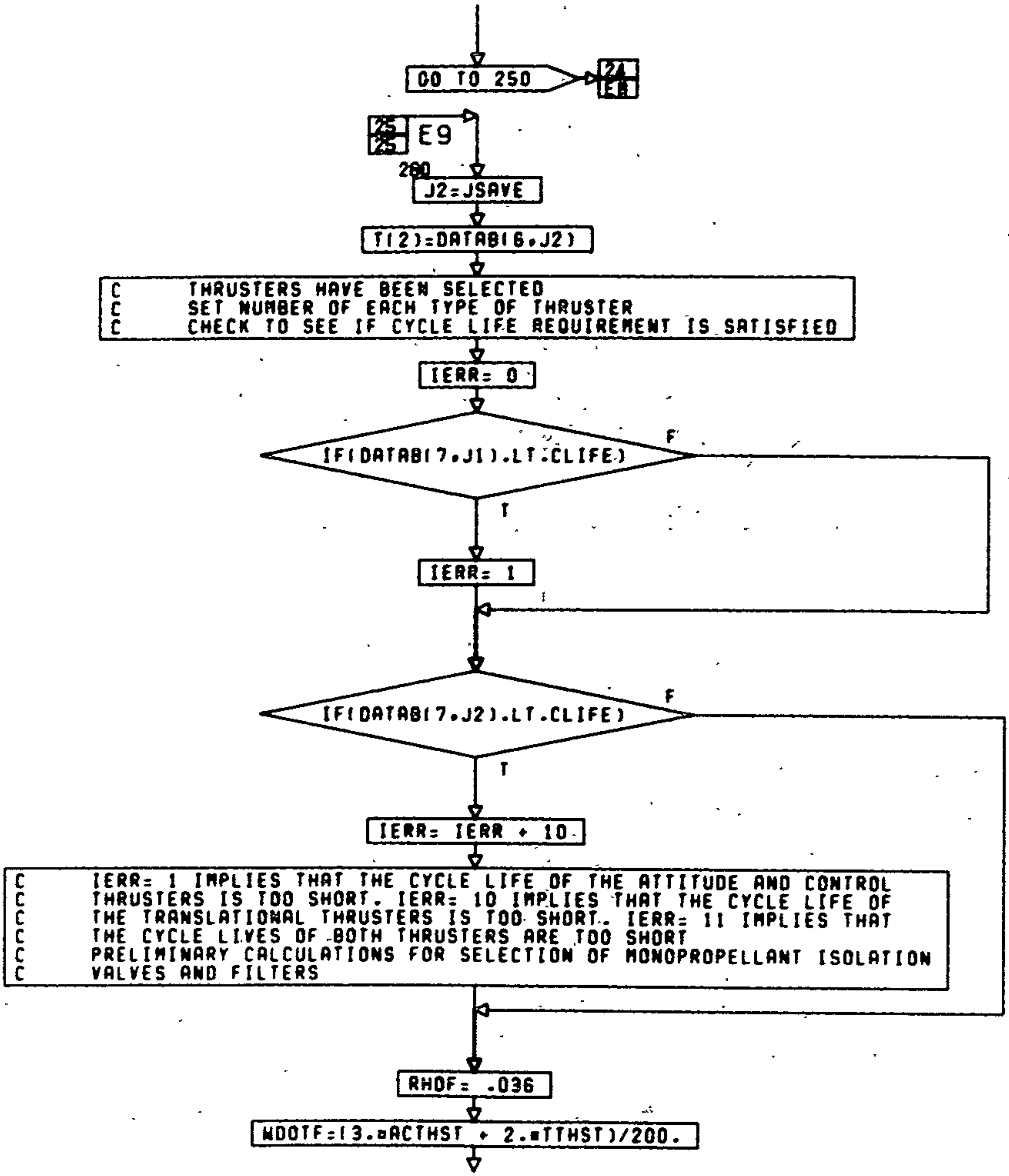
CONT. ON PG 24


23
E6
GO TO 230
23
E7
220
IF(J2.EQ.J1E)
F
T
GO TO 240
J2= J2 + 1
GO TO 210
23
E5
230
IACCPT(I)= J2
I= I + 1
GO TO 220
240
CONTINUE
IMAX= I - 1
I= 1
J2= IACCPT(I)
THRUST= DATAB(6,J2)
DIFOLD= ABS(THRUST - TTHST)
E8
26
250
ICHOSE(2)= DATAB(1,J2)
JSAVE=J2

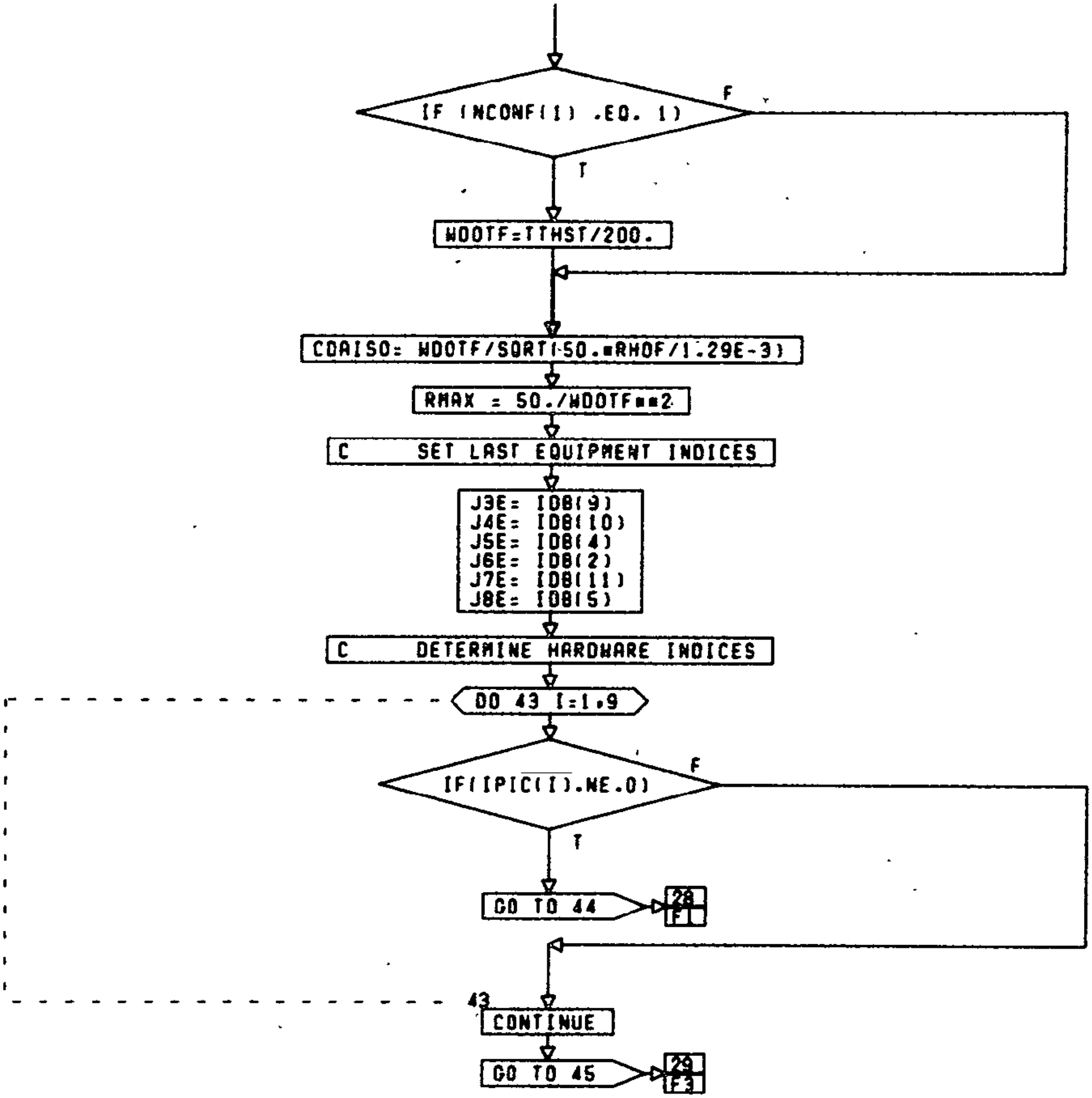
CONT. ON PG 25


IF(I.EQ.IMAX)
F
T
GO TO 280
26
E9
260
I= I + 1
J2= IACCPT(I)
THRUST= DATAB(6,J2)
DIFNEW= ABS(THRUST - TTHST)
IF(DIFNEW.LE.DIFOLD)
F
T
GO TO 270
IF(I.LT.IMAX)
F
T
GO TO 260
GO TO 280
26
E9
270
DIFOLD= DIFNEW

CONT. ON PG 26

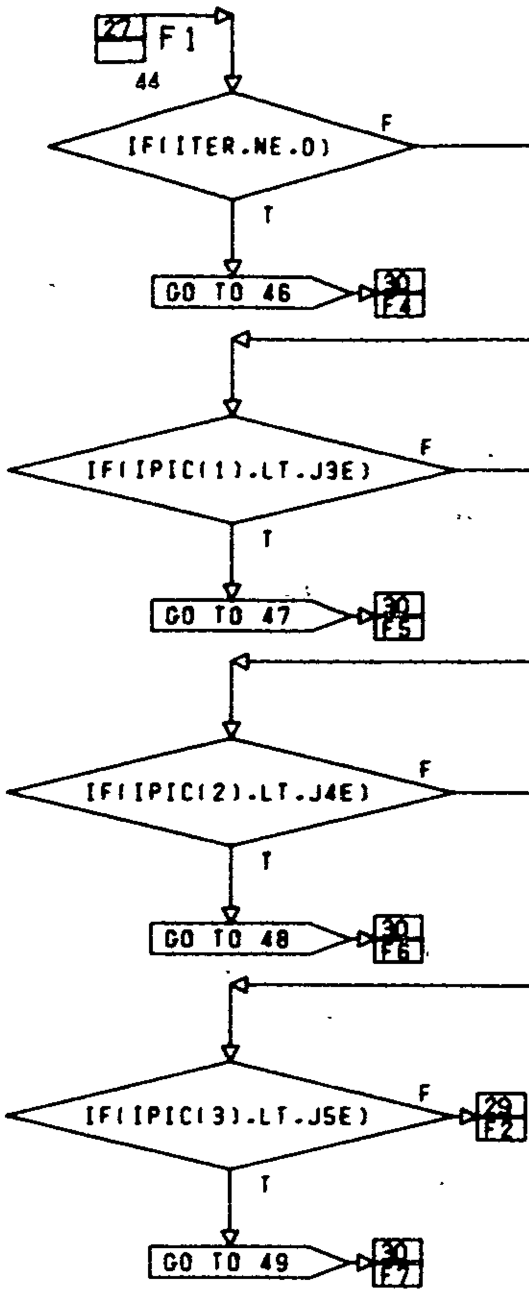

GO TO 250
24
E8
25
25
E9
260
J2=JSAVE
T(2)=DATAB(6,J2)
C THRUSTERS HAVE BEEN SELECTED
C SET NUMBER OF EACH TYPE OF THRUSTER
C CHECK TO SEE IF CYCLE LIFE REQUIREMENT IS SATISFIED
IERR= 0
IF(DATAB(7,J1).LT.CLIFE)
F
T
IERR= 1
IF(DATAB(7,J2).LT.CLIFE)
F
T
IERR= IERR + 10
C IERR= 1 IMPLIES THAT THE CYCLE LIFE OF THE ATTITUDE AND CONTROL
C THRUSTERS IS TOO SHORT. IERR= 10 IMPLIES THAT THE CYCLE LIFE OF
C THE TRANSLATIONAL THRUSTERS IS TOO SHORT. IERR= 11 IMPLIES THAT
C THE CYCLE LIVES OF BOTH THRUSTERS ARE TOO SHORT
C PRELIMINARY CALCULATIONS FOR SELECTION OF MONOPROPELLANT ISOLATION
C VALVES AND FILTERS
RHOF= .036
WDOTF=(3.*ACTHST + 2.*TTHST)/200.

CONT. ON PG 27

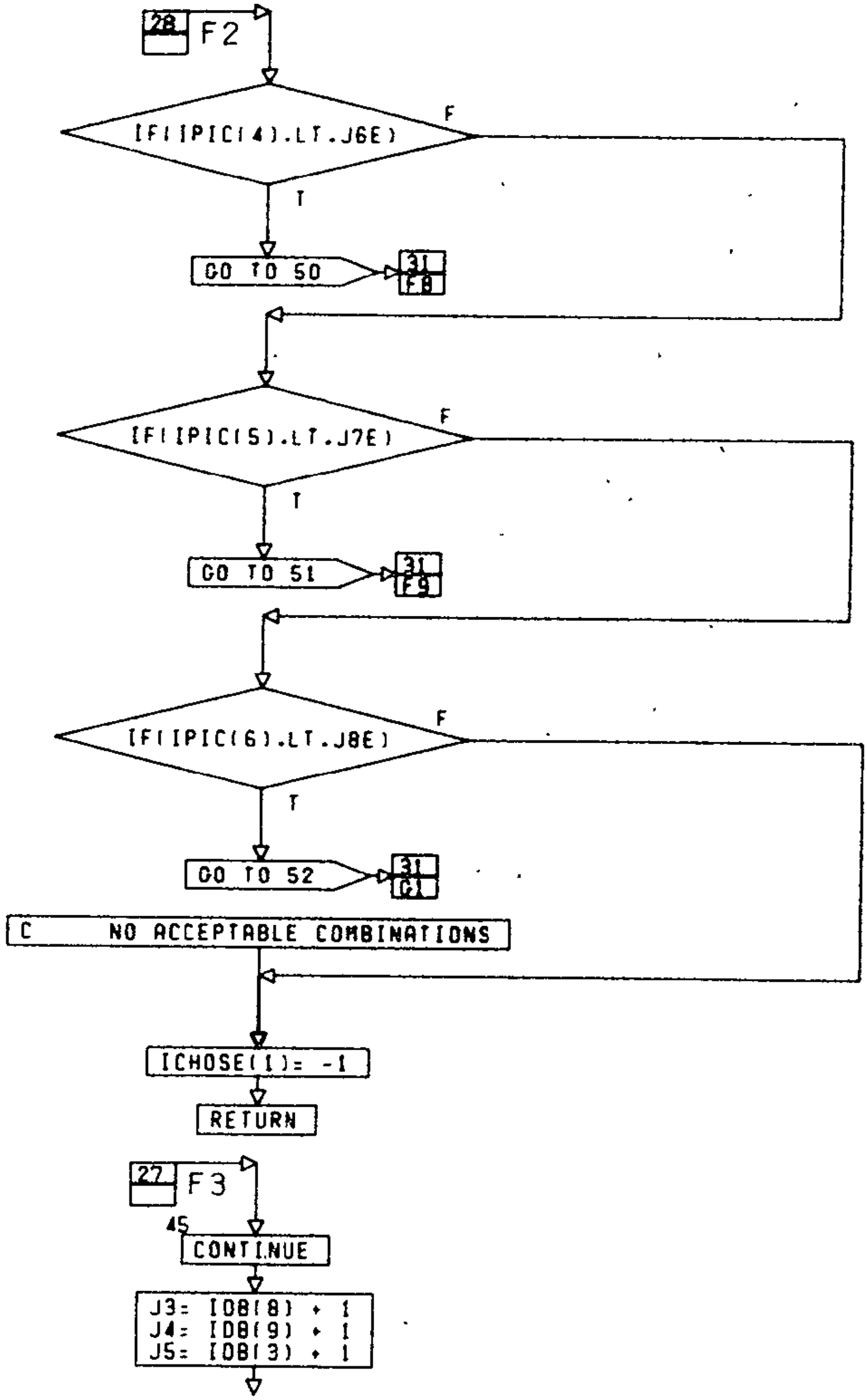


IF (NCONF(1) .EQ. 1)
F
T
WDOTF=TTHST/200.
CDAISO= WDOTF/SQRT(50.*RHOF/1.29E-3)
RMAX = 50./WDOTF**2
C SET LAST EQUIPMENT INDICES
J3E= IDB(9)
J4E= IDB(10)
J5E= IDB(4)
J6E= IDB(2)
J7E= IDB(11)
J8E= IDB(5)
C DETERMINE HARDWARE INDICES
DO 43 I=1,9
IF(IPIC(I).NE.0)
F
T
GO TO 44
28
F1
43
CONTINUE
GO TO 45
29
F3

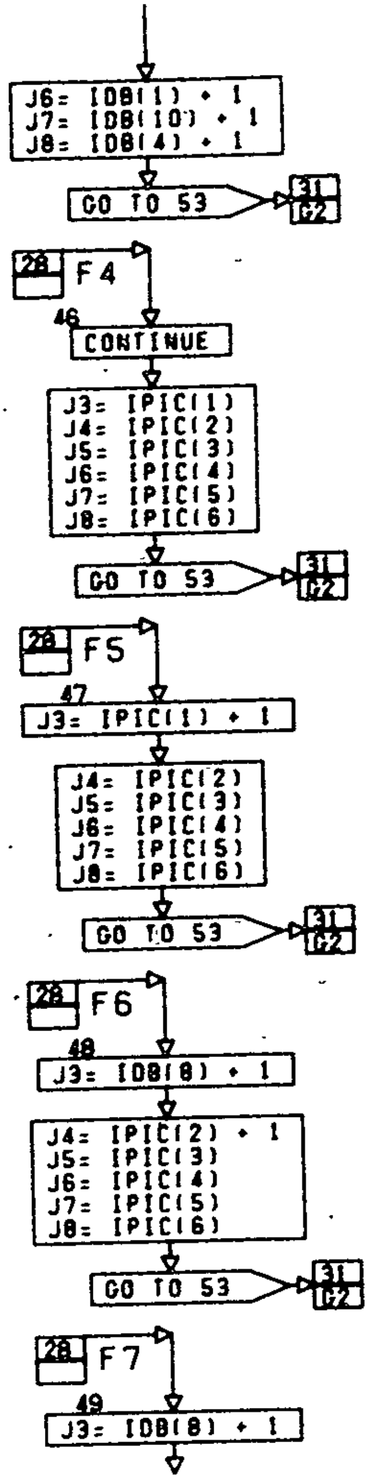
CONT. ON PG 28


27
F1
44
IF(ITER.NE.0)
F
T
GO TO 46
30
F4
IF(IPIC(1).LT.J3E)
F
T
GO TO 47
30
F5
IF(IPIC(2).LT.J4E)
F
T
GO TO 48
30
F6
IF(IPIC(3).LT.J5E)
F
29
F2
T
GO TO 49
30
F7

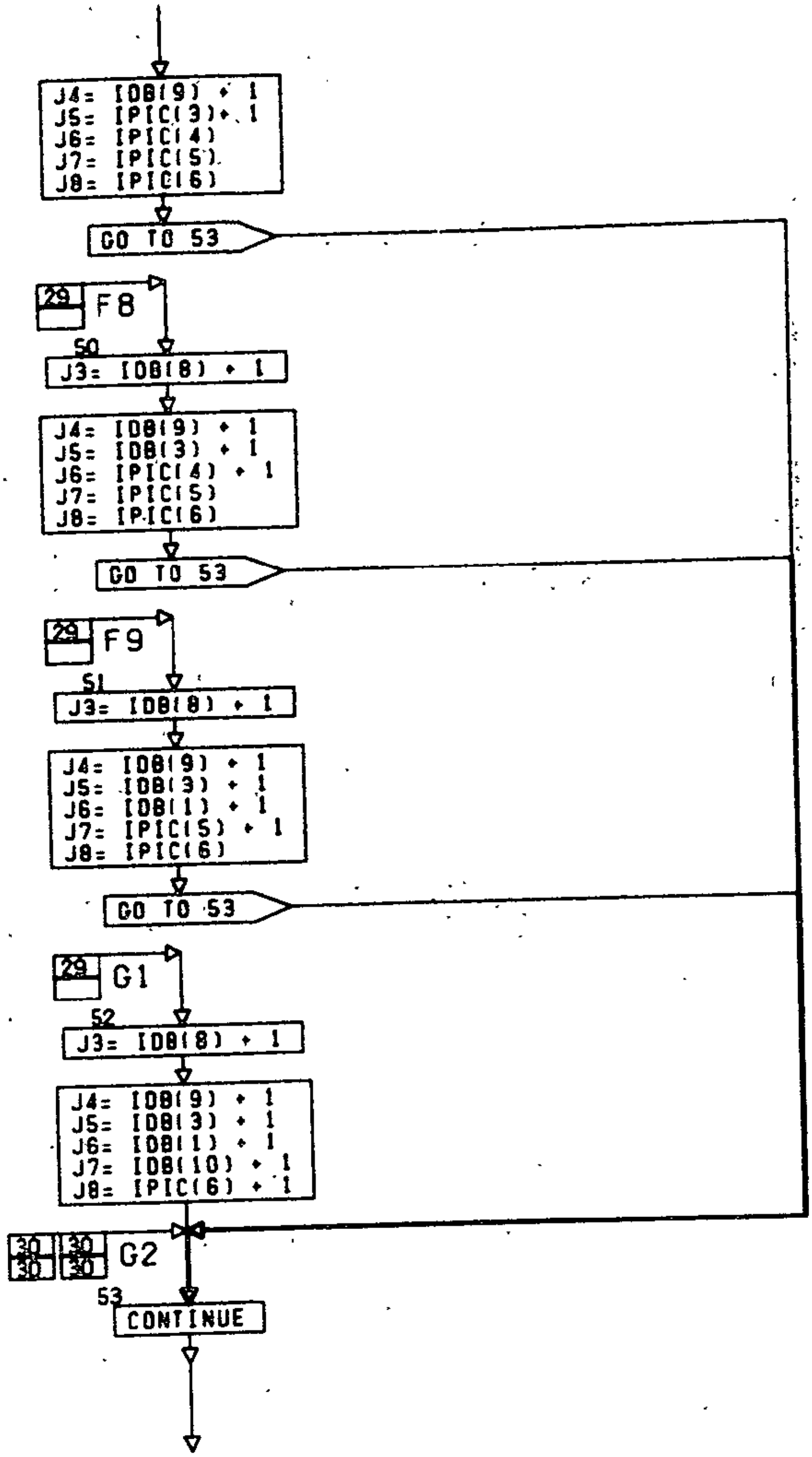
CONT. ON PG 29


28
F2
IF(IPIC(4).LT.J6E)
F
T
GO TO 50
31
F8
IF(IPIC(5).LT.J7E)
F
T
GO TO 51
31
F9
IF(IPIC(6).LT.J8E)
F
T
GO TO 52
31
C1
C NO ACCEPTABLE COMBINATIONS
ICHOSE(1)= -1
RETURN
27
F3
45
CONTINUE
J3= IDB(8) + 1
J4= IDB(9) + 1
J5= IDB(3) + 1

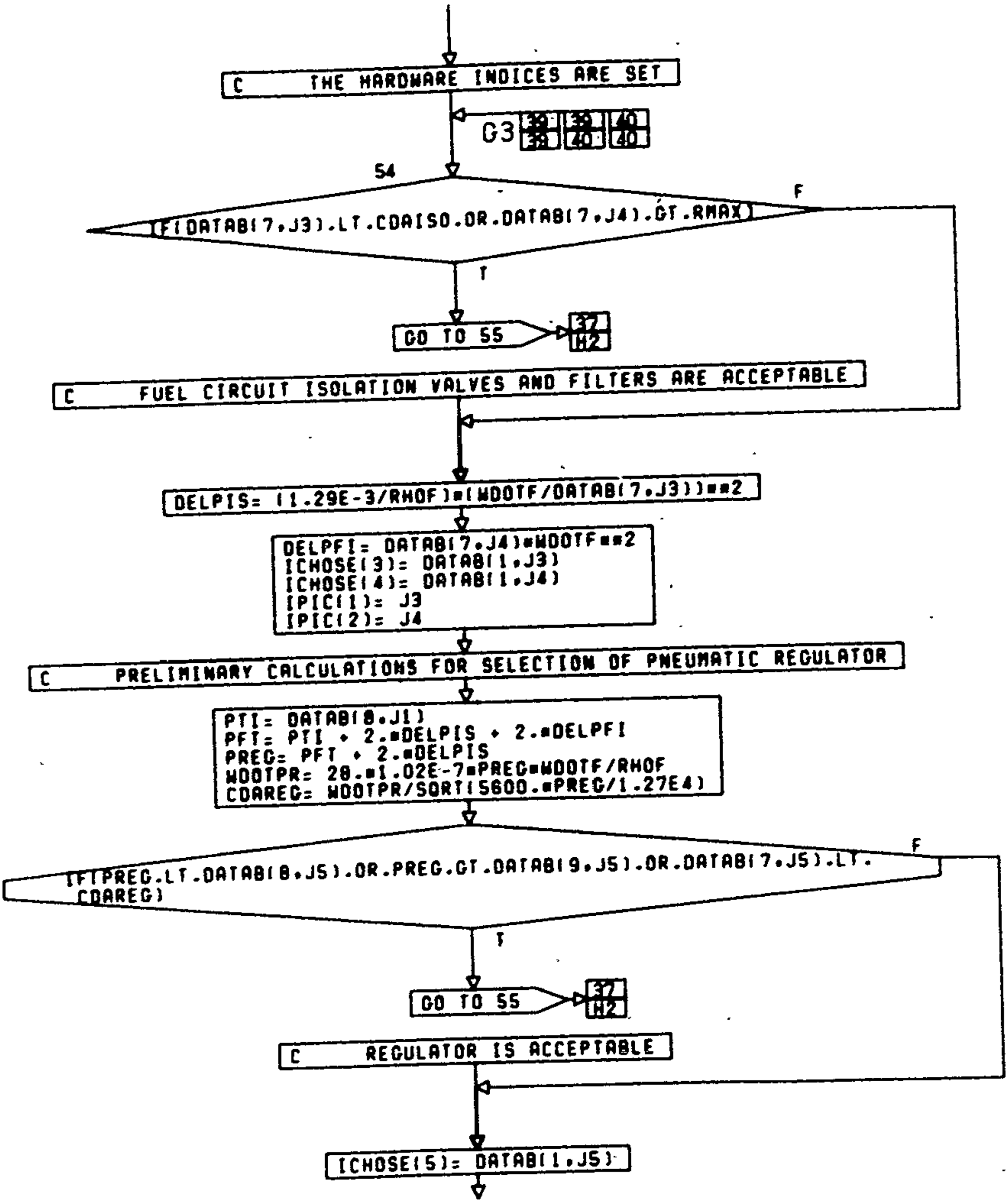
CONT. ON PG 30


J6= IDB(1) + 1
J7= IDB(10) + 1
J8= IDB(4) + 1
GO TO 53
31
G2
28
F4
46
CONTINUE
J3= IPIC(1)
J4= IPIC(2)
J5= IPIC(3)
J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
GO TO 53
31
G2
28
F5
47
J3= IPIC(1) + 1
J4= IPIC(2)
J5= IPIC(3)
J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
GO TO 53
31
G2
28
F6
48
J3= IDB(8) + 1
J4= IPIC(2) + 1
J5= IPIC(3)
J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
GO TO 53
31
G2
28
F7
49
J3= IDB(8) + 1

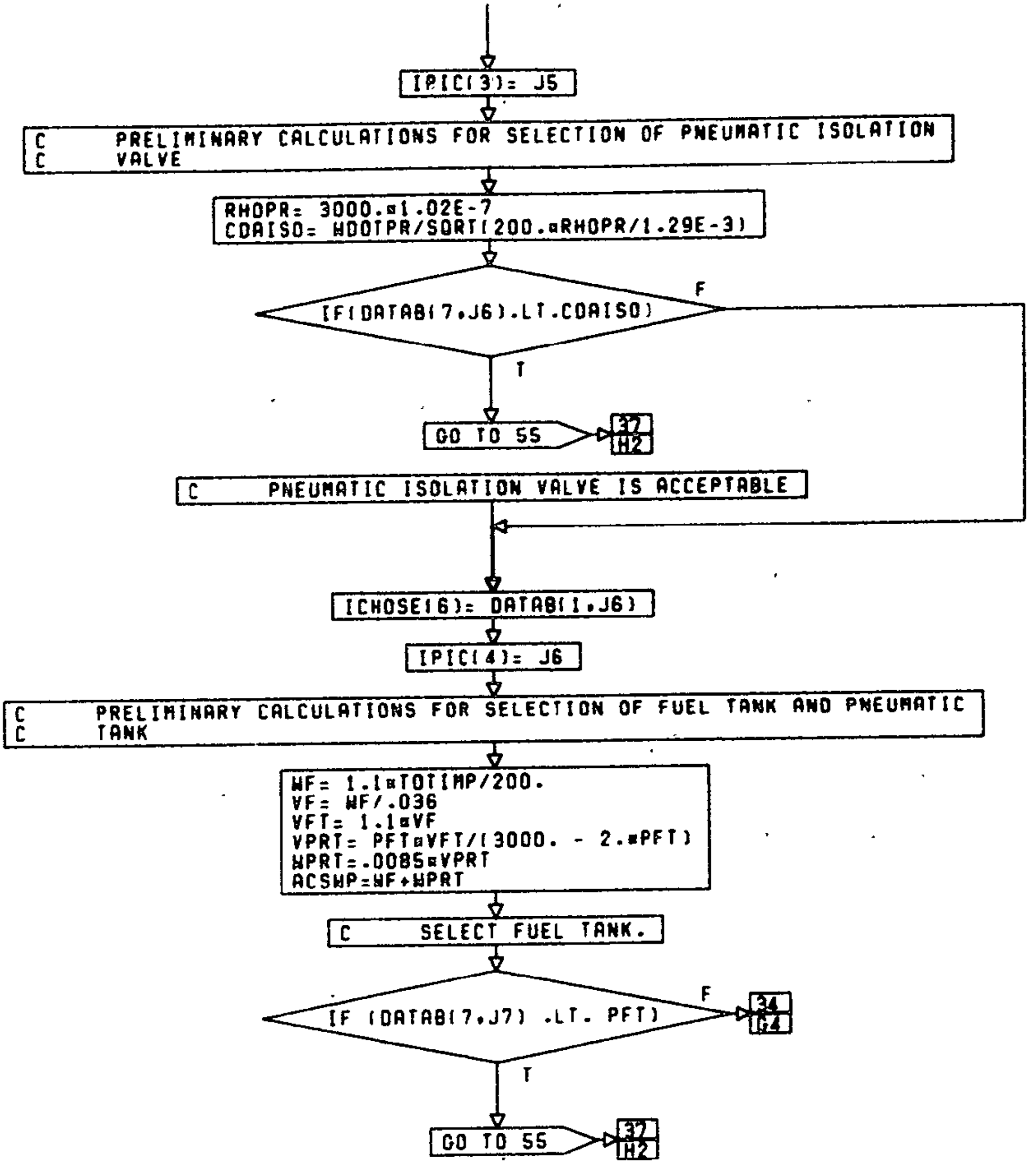
CONT. ON PG 31


J4= IDB(9) + 1
J5= IPIC(3)+ 1
J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
GO TO 53
29
F8
50
J3= IDB(8) + 1
J4= IDB(9) + 1
J5= IDB(3) + 1
J6= IPIC(4) + 1
J7= IPIC(5)
J8= IPIC(6)
GO TO 53
29
F9
51
J3= IDB(8) + 1
J4= IDB(9) + 1
J5= IDB(3) + 1
J6= IDB(1) + 1
J7= IPIC(5) + 1
J8= IPIC(6)
GO TO 53
29
G1
52
J3= IDB(8) + 1
J4= IDB(9) + 1
J5= IDB(3) + 1
J6= IDB(1) + 1
J7= IDB(10) + 1
J8= IPIC(6) + 1
30 30
30 30
G2
53
CONTINUE

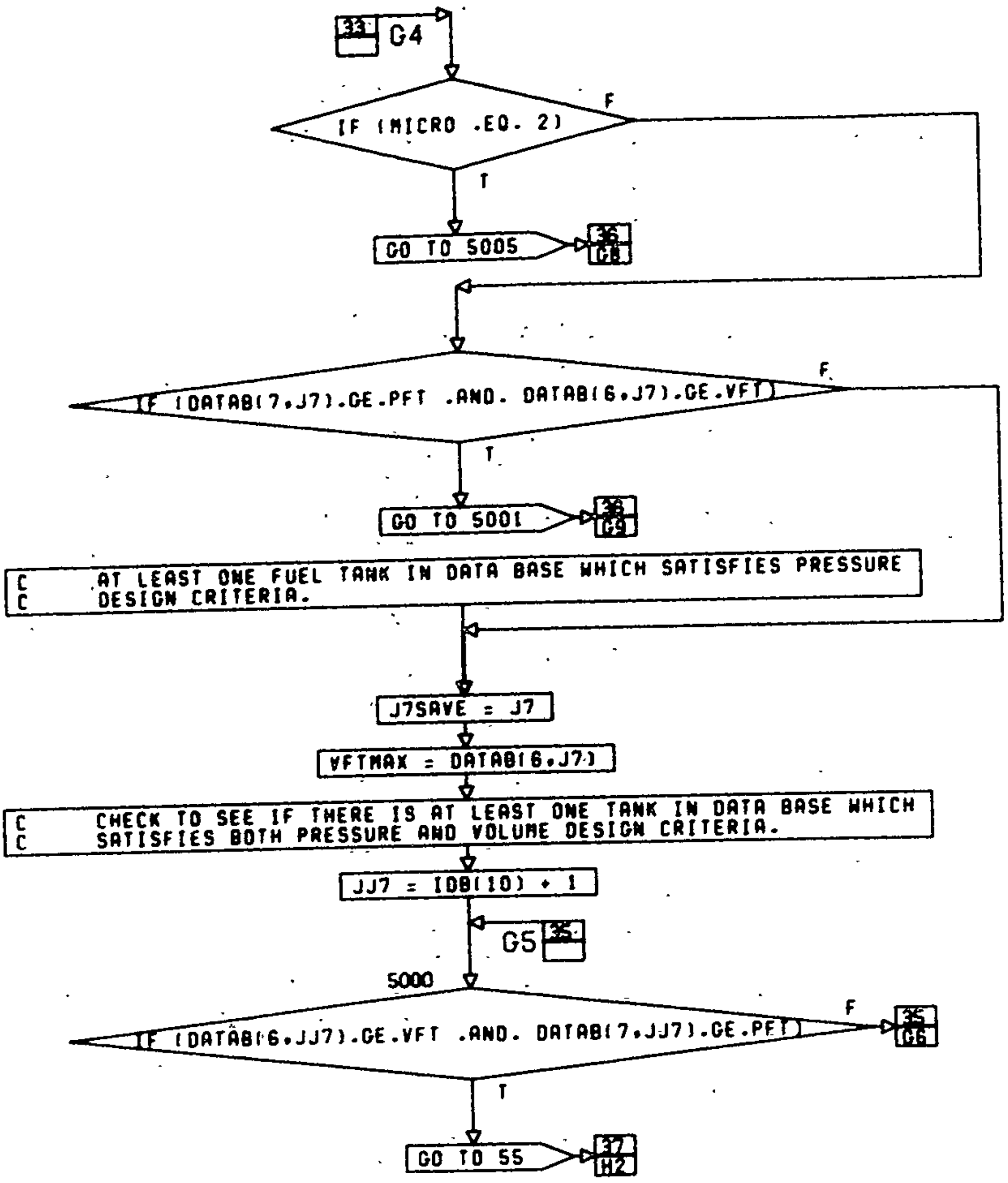
CONT. ON PG 32


C THE HARDWARE INDICES ARE SET
G3 39 39 40 39 40 40
54
IF(DATAB(7,J3).LT.CDAISO.OR.DATAB(7,J4).GT.RMAX)
F
T
GO TO 55
37 H2
C FUEL CIRCUIT ISOLATION VALVES AND FILTERS ARE ACCEPTABLE
DELPIS= (1.29E-3/RHOF)*(WDOTF/DATAB(7,J3))**2
DELPFI= DATAB(7,J4)*WDOTF**2
ICHOSE(3)= DATAB(1,J3)
ICHOSE(4)= DATAB(1,J4)
IPIC(1)= J3
IPIC(2)= J4
C PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC REGULATOR
PTI= DATAB(8,J1)
PFT= PTI + 2.*DELPIS + 2.*DELPFI
PREG= PFT + 2.*DELPIS
WDOTPR= 28.*1.02E-7*PREG*WDOTF/RHOF
CDAREG= WDOTPR/SQRT(5600.*PREG/1.27E4)
IF(PREG.LT.DATAB(8,J5).OR.PREG.GT.DATAB(9,J5).OR.DATAB(7,J5).LT.CDAREG)
F
T
GO TO 55
37 H2
C REGULATOR IS ACCEPTABLE
ICHOSE(5)= DATAB(1,J5)

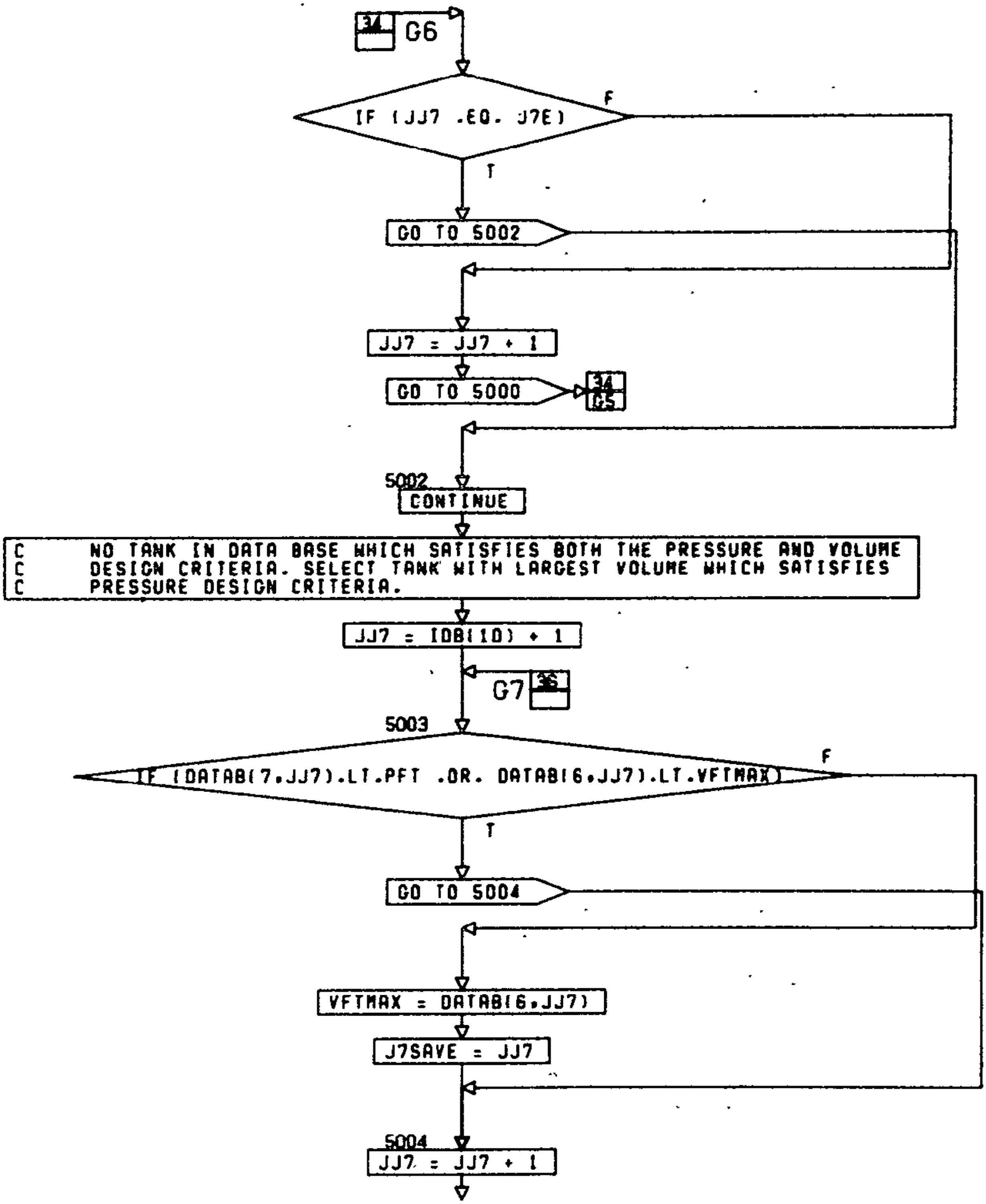
CONT. ON PG 33


IPIC(3)= J5
C PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC ISOLATION
C VALVE
RHOPR= 3000.*1.02E-7
CDAISO= WDOTPR/SQRT(200.*RHOPR/1.29E-3)
IF(DATAB(7,J6).LT.CDAISO)
F
T
GO TO 55
37
H2
C PNEUMATIC ISOLATION VALVE IS ACCEPTABLE
ICHOSE(6)= DATAB(1,J6)
IPIC(4)= J6
C PRELIMINARY CALCULATIONS FOR SELECTION OF FUEL TANK AND PNEUMATIC
C TANK
WF= 1.1*TOTIMP/200.
VF= WF/.036
VFT= 1.1*VF
VPRT= PFT*VFT/(3000. - 2.*PFT)
WPRT=.0085*VPRT
ACSWP=WF+WPRT
C SELECT FUEL TANK.
IF (DATAB(7,J7) .LT. PFT)
F
34
G4
T
GO TO 55
37
H2

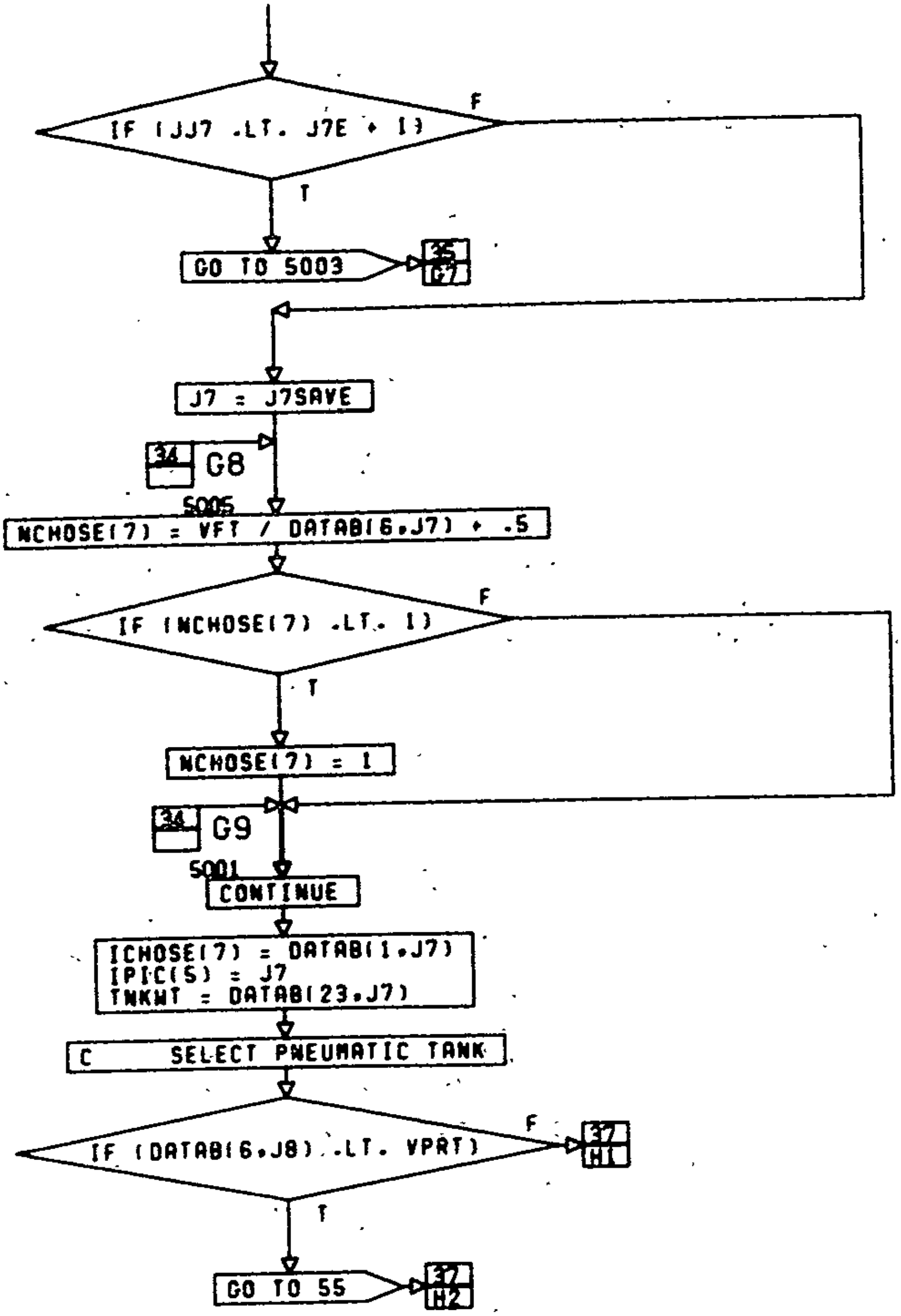
CONT. ON PG 34


33
G4
IF (MICRO .EQ. 2)
F
T
GO TO 5005
36
G8
IF (DATAB(7,J7).GE.PFT .AND. DATAB(6,J7).GE.VFT)
F
T
GO TO 5001
36
G9
C AT LEAST ONE FUEL TANK IN DATA BASE WHICH SATISFIES PRESSURE
C DESIGN CRITERIA.
J7SAVE = J7
VFTMAX = DATAB(6,J7)
C CHECK TO SEE IF THERE IS AT LEAST ONE TANK IN DATA BASE WHICH
C SATISFIES BOTH PRESSURE AND VOLUME DESIGN CRITERIA.
JJ7 = IDB(10) + 1
G5
35
5000
IF (DATAB(6,JJ7).GE.VFT .AND. DATAB(7,JJ7).GE.PFT)
F
35
G6
T
GO TO 55
37
H2

CONT. ON PG 35

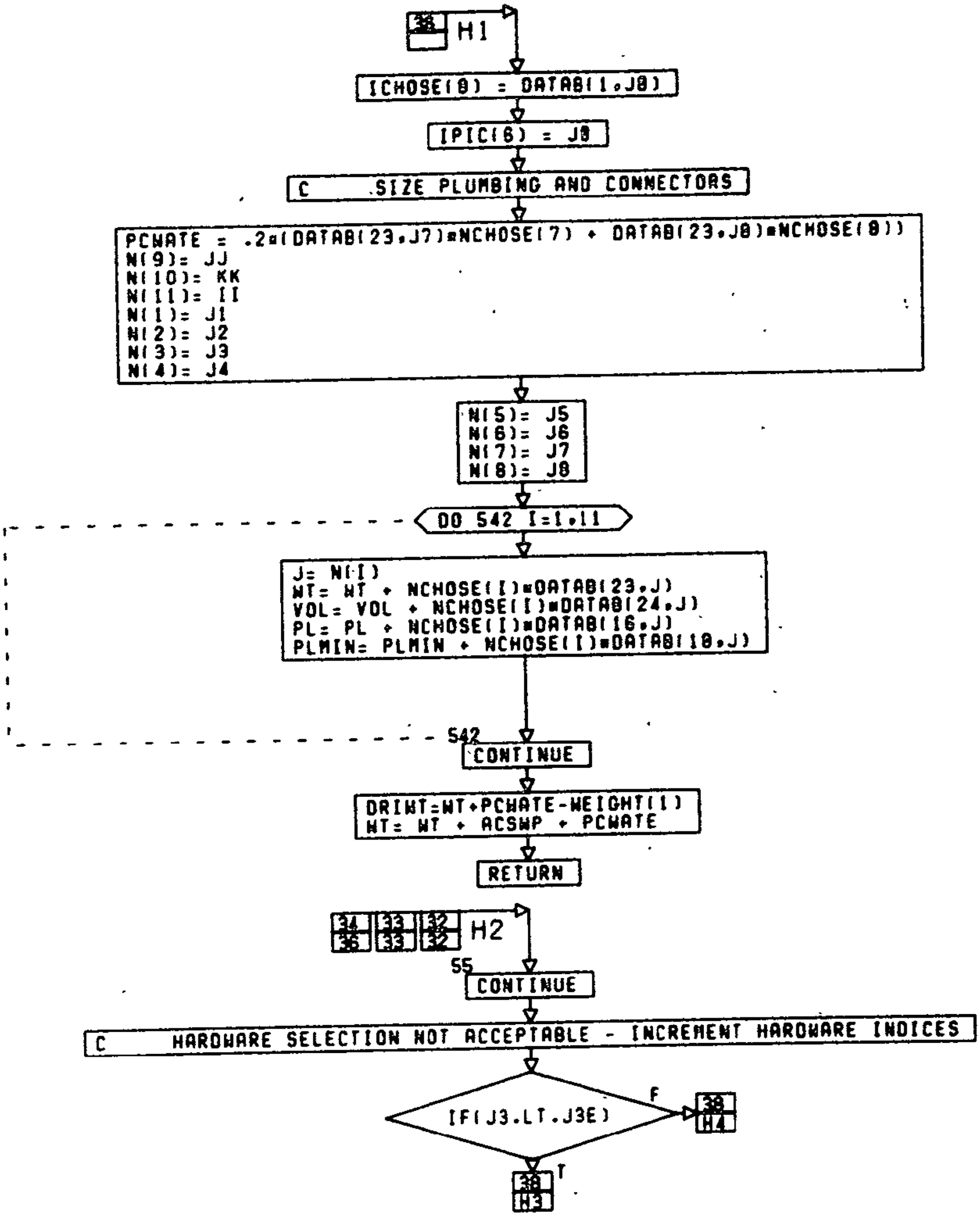

34
G6
IF (JJ7 .EQ. J7E)
F
T
GO TO 5002
JJ7 = JJ7 + 1
GO TO 5000
34
G5
5002
CONTINUE
C NO TANK IN DATA BASE WHICH SATISFIES BOTH THE PRESSURE AND VOLUME
C DESIGN CRITERIA. SELECT TANK WITH LARGEST VOLUME WHICH SATISFIES
C PRESSURE DESIGN CRITERIA.
JJ7 = IDB(10) + 1
G7
36
5003
IF (DATAB(7,JJ7).LT.PFT .OR. DATAB(6,JJ7).LT.VFTMAX)
F
T
GO TO 5004
VFTMAX = DATAB(6,JJ7)
J7SAVE = JJ7
5004
JJ7 = JJ7 + 1

CONT. ON PG 36

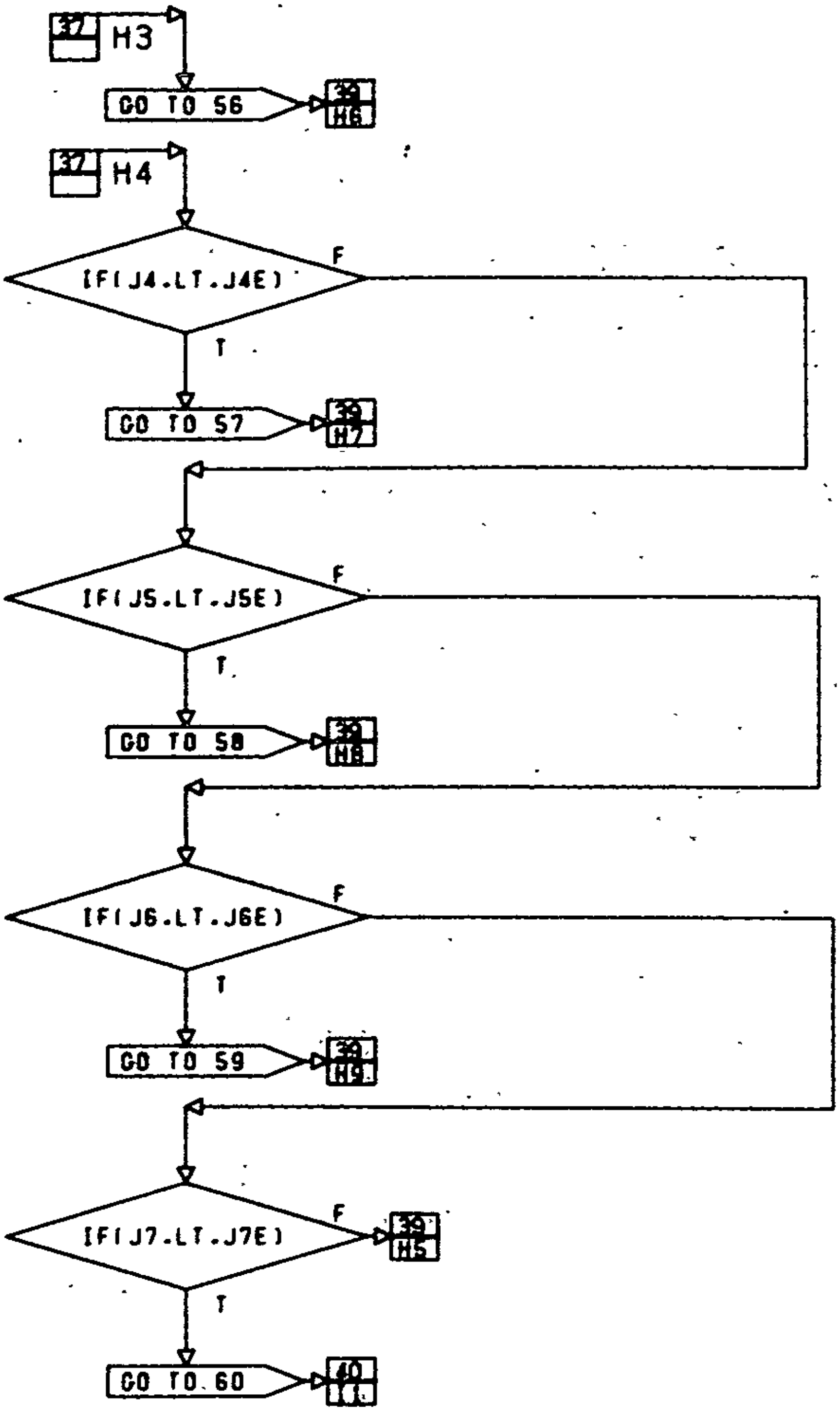


IF (JJ7 .LT. J7E + 1)
F
T
GO TO 5003
35
G7
J7 = J7SAVE
34
G8
5005
NCHOSE(7) = VFT / DATAB(6,J7) + .5
IF (NCHOSE(7) .LT. 1)
F
T
NCHOSE(7) = 1
34
G9
5001
CONTINUE
ICHOSE(7) = DATAB(1,J7)
IPIC(5) = J7
TNKWT = DATAB(23,J7)
C SELECT PNEUMATIC TANK
IF (DATAB(6,J8) .LT. VPRT)
F
37
H1
T
GO TO 55
37
H2

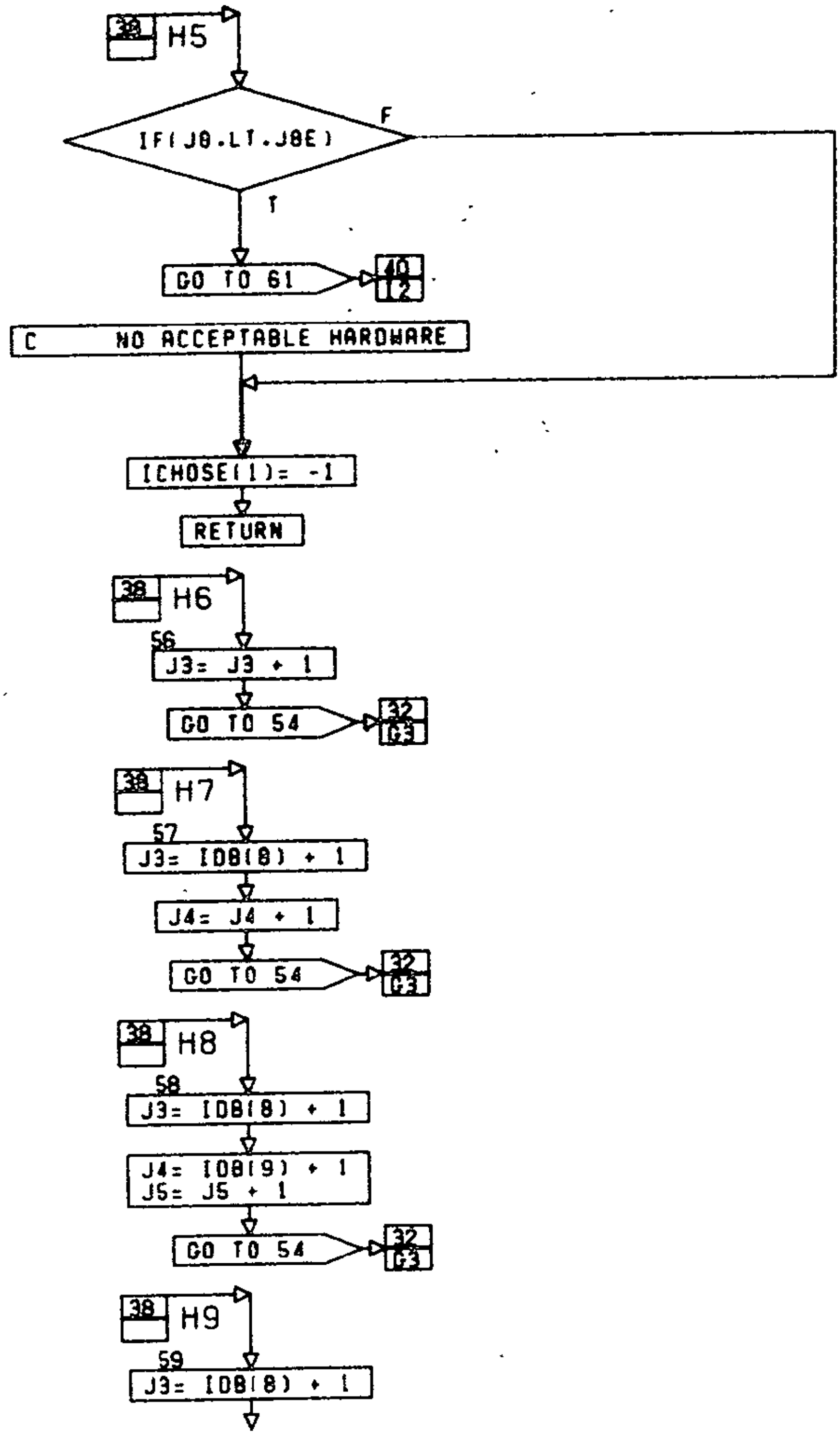
CONT. ON PG 37


38
H1
ICHOSE(8) = DATAB(1,J8)
IPIC(8) = J8
C .SIZE PLUMBING AND CONNECTORS
PCWATE = .2*(DATAB(23,J7)*NCHOSE(7) + DATAB(23,J8)*NCHOSE(8))
N(9)= JJ
N(10)= KK
N(11)= II
N(1)= J1
N(2)= J2
N(3)= J3
N(4)= J4
N(5)= J5
N(6)= J6
N(7)= J7
N(8)= J8
DO 542 I=1,11
J= N(I)
WT= WT + NCHOSE(I)*DATAB(23,J)
VOL= VOL + NCHOSE(I)*DATAB(24,J)
PL= PL + NCHOSE(I)*DATAB(16,J)
PLMIN= PLMIN + NCHOSE(I)*DATAB(18,J)
542
CONTINUE
DRIWT=WT+PCWATE-WEIGHT(1)
WT= WT + ACSWP + PCWATE
RETURN
34
36
33
33
32
32
H2
55
CONTINUE
C HARDWARE SELECTION NOT ACCEPTABLE - INCREMENT HARDWARE INDICES
IF(J3.LT.J3E)
F
38
H4
T
38
H3

CONT. ON PG 38

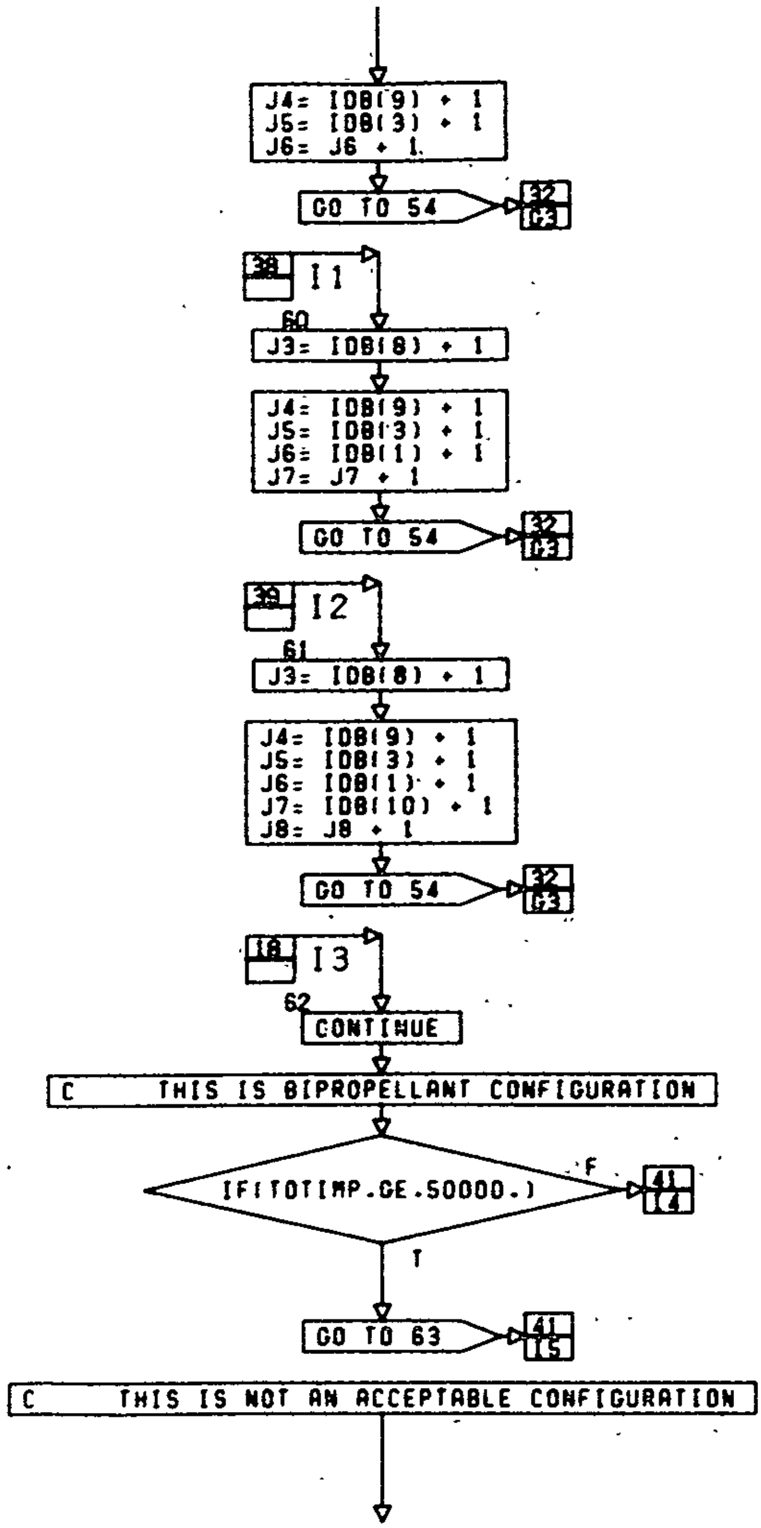

37
H3
GO TO 56
39
H6
37
H4
IF(J4.LT.J4E)
F
T
GO TO 57
39
H7
IF(J5.LT.J5E)
F
T
GO TO 58
39
H8
IF(J6.LT.J6E)
F
T
GO TO 59
39
H9
IF(J7.LT.J7E)
F
39
H5
T
GO TO 60
40
I1

CONT. ON PG 39



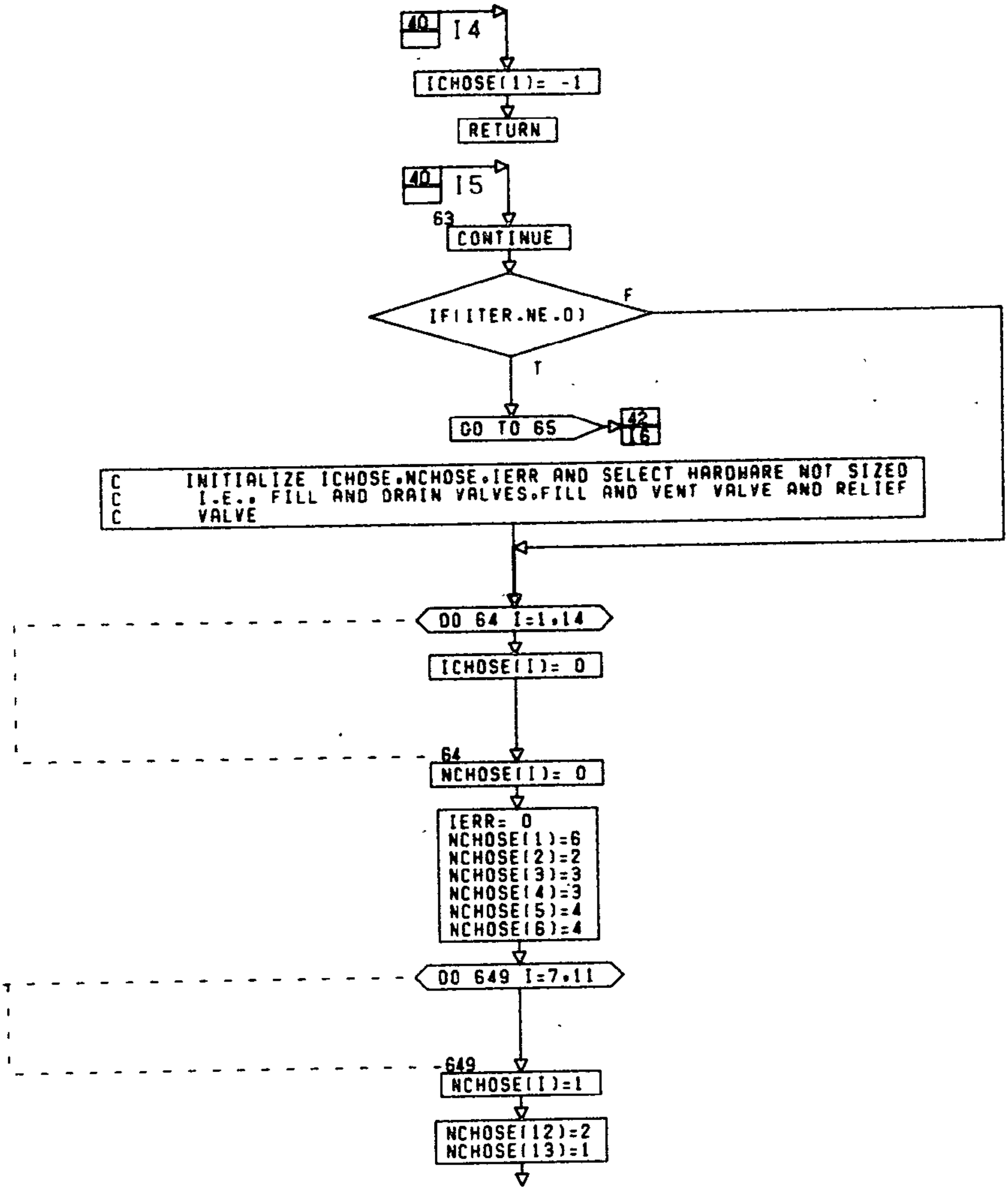
38 H5
IF(J8.LT.J8E)
F
T
GO TO 61
40 I2
C NO ACCEPTABLE HARDWARE
ICHOSE(1)= -1
RETURN
38 H6
56
J3= J3 + 1
GO TO 54
32 G3
38 H7
57
J3= IDB(8) + 1
J4= J4 + 1
GO TO 54
32 G3
38 H8
58
J3= IDB(8) + 1
J4= IDB(9) + 1
J5= J5 + 1
GO TO 54
32 G3
38 H9
59
J3= IDB(8) + 1

CONT. ON PG 40

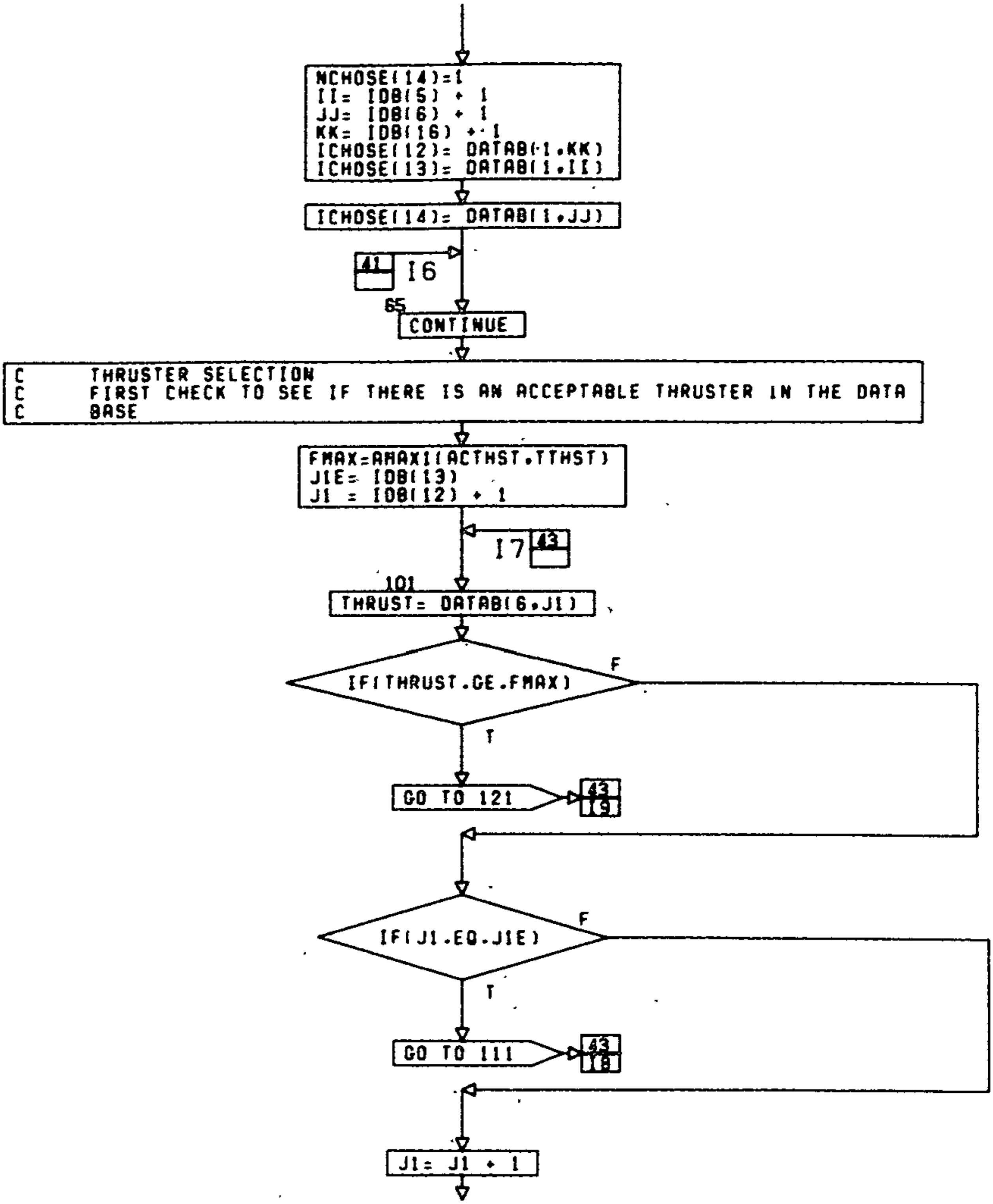


J4= IDB(9) + 1
J5= IDB(3) + 1
J6= J6 + 1
GO TO 54
32
I03
38
I1
60
J3= IDB(8) + 1
J4= IDB(9) + 1
J5= IDB(3) + 1
J6= IDB(1) + 1
J7= J7 + 1
GO TO 54
32
I03
39
I2
61
J3= IDB(8) + 1
J4= IDB(9) + 1
J5= IDB(3) + 1
J6= IDB(1) + 1
J7= IDB(10) + 1
J8= J8 + 1
GO TO 54
32
I03
18
I3
62
CONTINUE
C THIS IS BIPROPELLANT CONFIGURATION
IF(TOTIMP.GE.50000.)
F
41
I4
T
GO TO 63
41
I5
C THIS IS NOT AN ACCEPTABLE CONFIGURATION

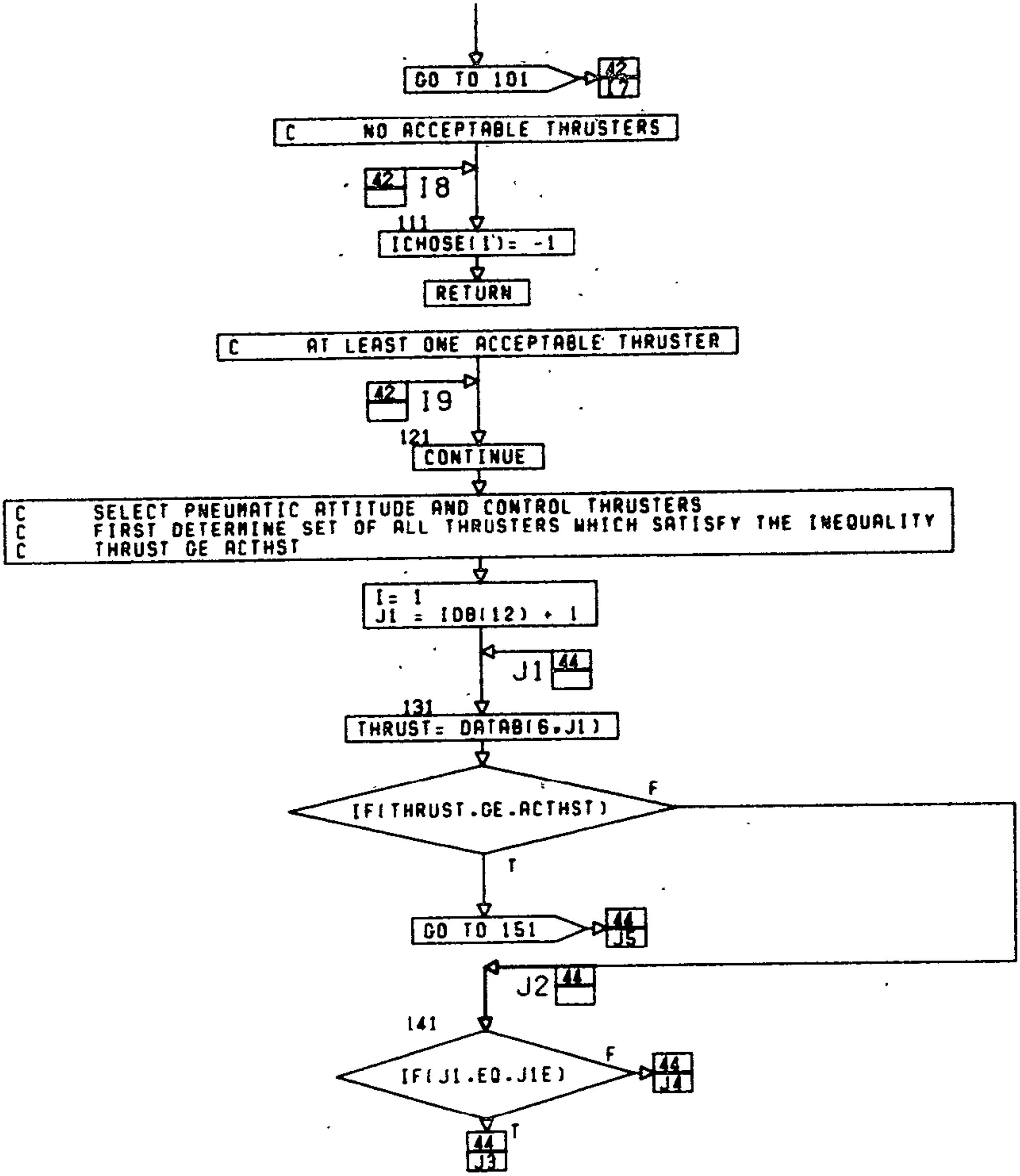
CONT. ON PG 41


40
I4
ICHOSE(1)= -1
RETURN
40
I5
63
CONTINUE
IF(ITER.NE.0)
F
T
GO TO 65
42
I6
C INITIALIZE ICHOSE,NCHOSE,IERR AND SELECT HARDWARE NOT SIZED
C I.E., FILL AND DRAIN VALVES,FILL AND VENT VALVE AND RELIEF
C VALVE
DO 64 I=1,14
ICHOSE(I)= 0
64
NCHOSE(I)= 0
IERR= 0
NCHOSE(1)=6
NCHOSE(2)=2
NCHOSE(3)=3
NCHOSE(4)=3
NCHOSE(5)=4
NCHOSE(6)=4
DO 649 I=7,11
649
NCHOSE(I)=1
NCHOSE(12)=2
NCHOSE(13)=1

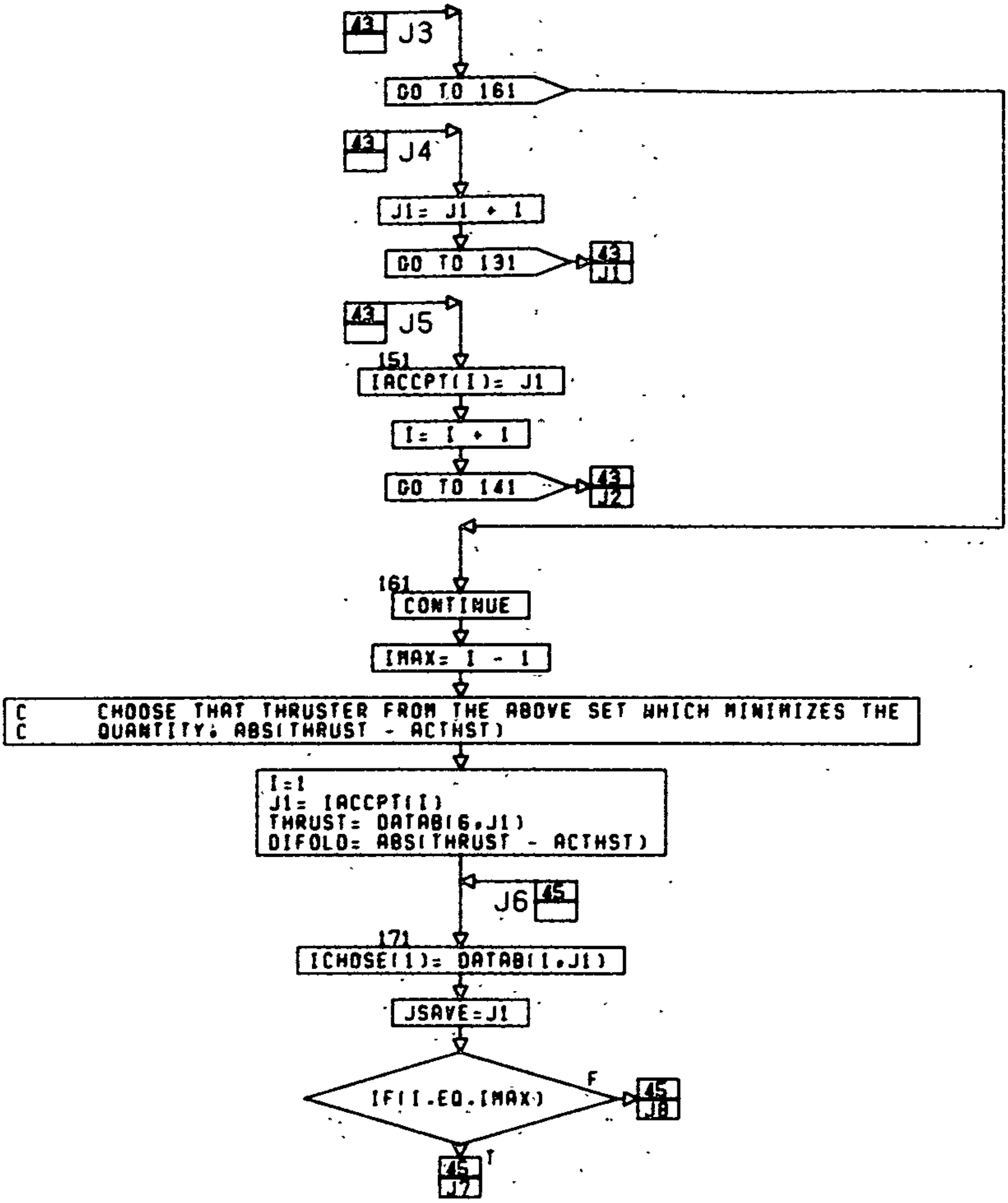
CONT. ON PG 42


NCHOSE(14)=1
II= IDB(5) + 1
JJ= IDB(6) + 1
KK= IDB(16) + 1
ICHOSE(12)= DATAB(1,KK)
ICHOSE(13)= DATAB(1,II)
ICHOSE(14)= DATAB(1,JJ)
41
I6
65
CONTINUE
C THRUSTER SELECTION
C FIRST CHECK TO SEE IF THERE IS AN ACCEPTABLE THRUSTER IN THE DATA
C BASE
FMAX=AMAX1(ACTHST,TTHST)
J1E= IDB(13)
J1 = IDB(12) + 1
I7
43
101
THRUST= DATAB(6,J1)
IF(THRUST.GE.FMAX)
F
T
GO TO 121
43
I9
IF(J1.EQ.J1E)
F
T
GO TO 111
43
I8
J1= J1 + 1

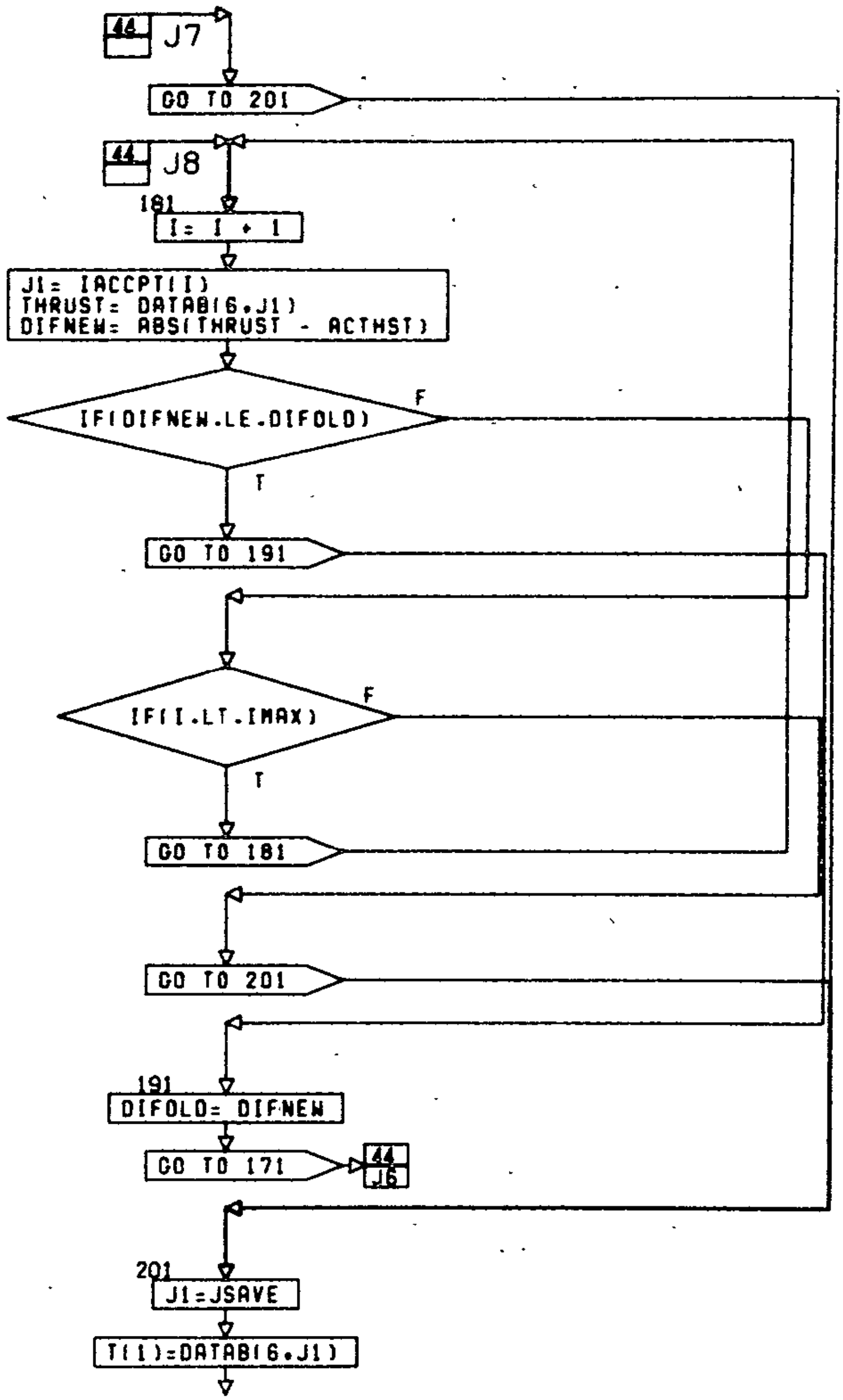
CONT. ON PG 43


GO TO 101
42
I7
C NO ACCEPTABLE THRUSTERS
42
I8
111
ICHOSE(I)= -1
RETURN
C AT LEAST ONE ACCEPTABLE THRUSTER
42
I9
121
CONTINUE
C SELECT PNEUMATIC ATTITUDE AND CONTROL THRUSTERS
C FIRST DETERMINE SET OF ALL THRUSTERS WHICH SATISFY THE INEQUALITY
C THRUST GE ACTHST
I= 1
J1 = IDB(12) + 1
J1
44
131
THRUST= DATAB(6,J1)
IF(THRUST.GE.ACTHST)
F
T
GO TO 151
44
J5
J2
44
141
IF(J1.EQ.J1E)
F
44
J4
T
44
J3

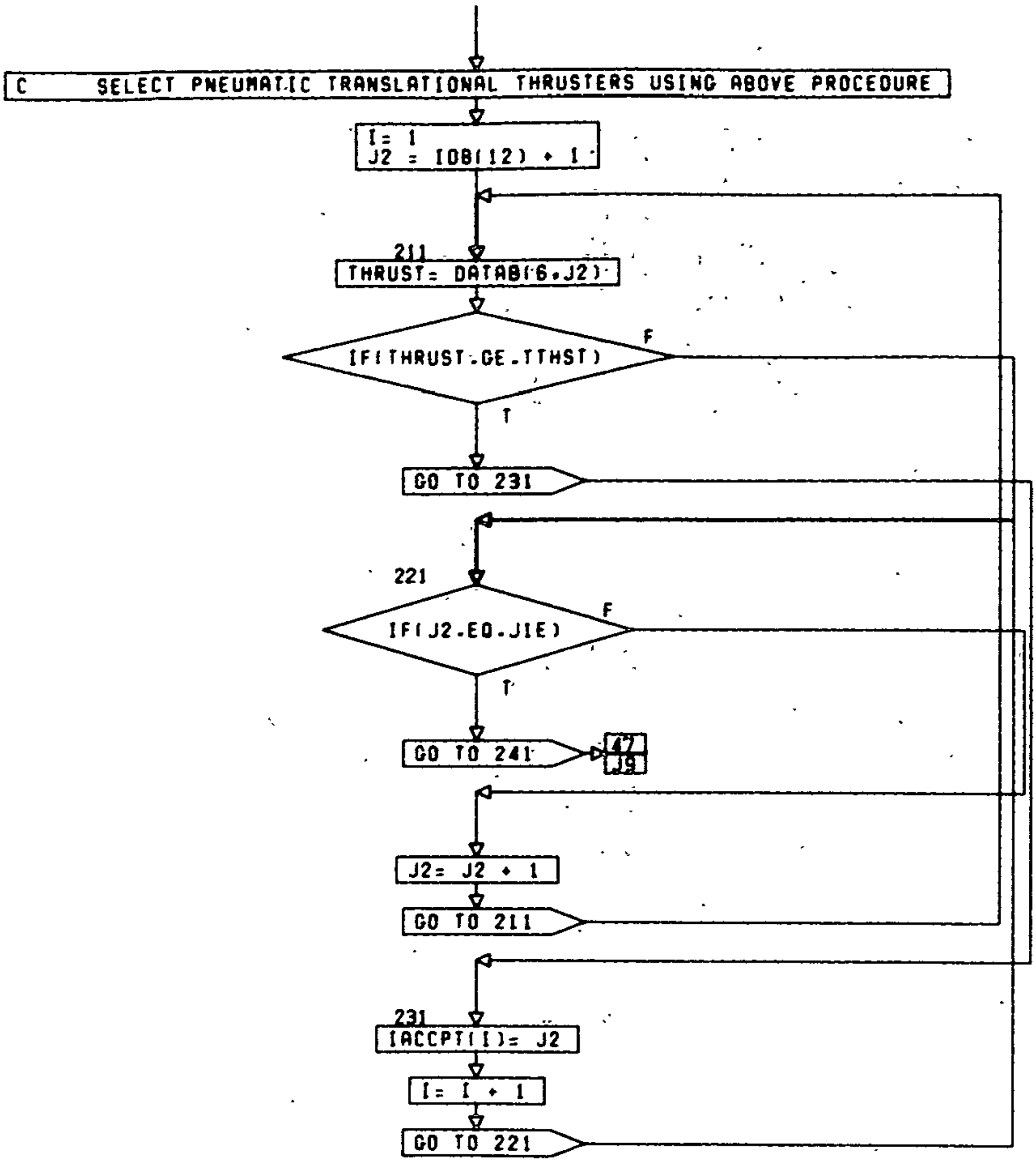
CONT. ON PG 44


43
J3
GO TO 161
43
J4
J1= J1 + 1
GO TO 131
43
J1
43
J5
151
IACCPT(I)= J1
I= I + 1
GO TO 141
43
J2
161
CONTINUE
IMAX= I - 1
C CHOOSE THAT THRUSTER FROM THE ABOVE SET WHICH MINIMIZES THE
C QUANTITY; ABS(THRUST - ACTHST)
I=1
J1= IACCPT(I)
THRUST= DATAB(6,J1)
DIFOLD= ABS(THRUST - ACTHST)
J6
45
171
ICHOSE(1)= DATAB(1,J1)
JSAVE=J1
IF(I.EQ.IMAX)
F
45
J8
T
45
J7

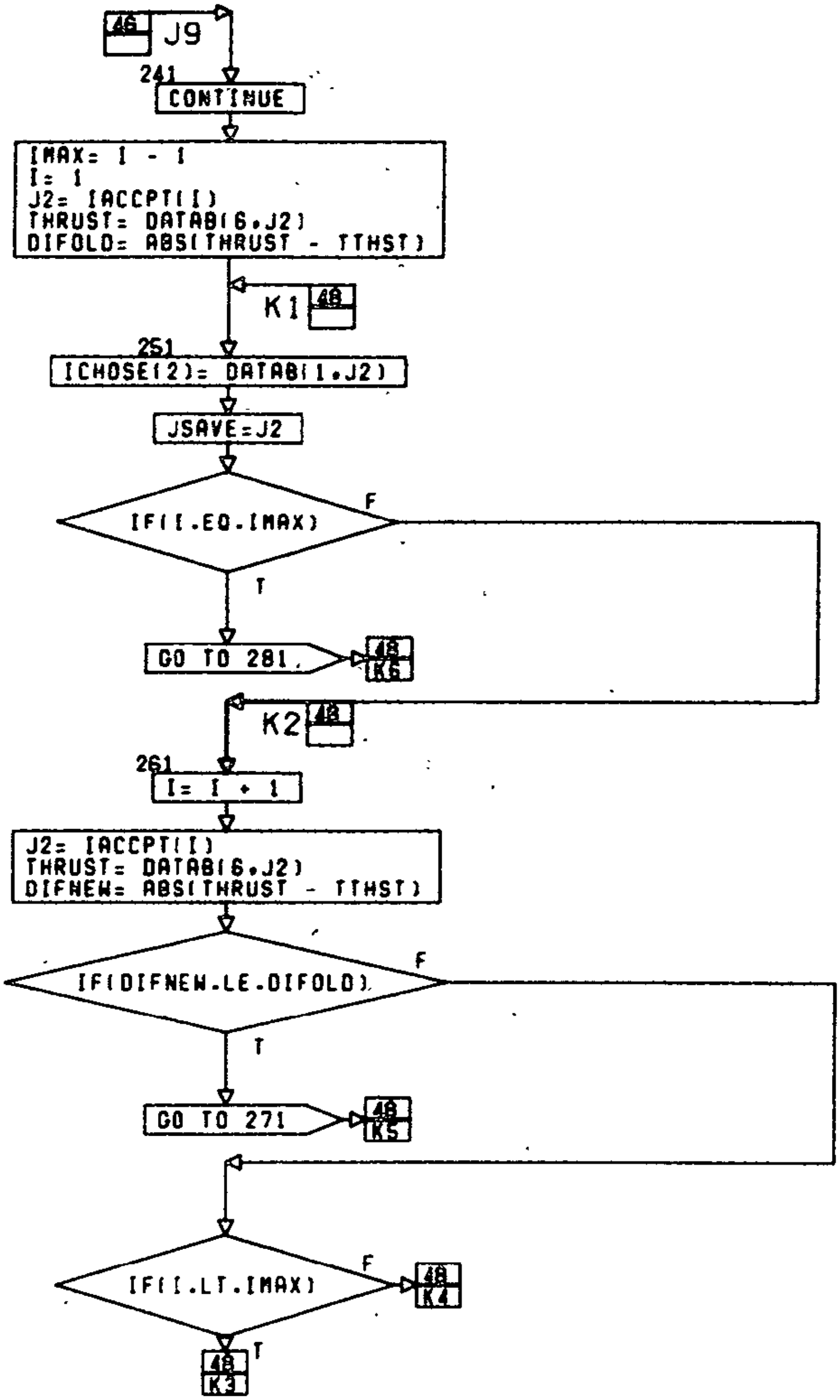
CONT. ON PG 45


44 J7
GO TO 201
44 J8
181
I= I + 1
J1= IACCPT(I)
THRUST= DATAB(6,J1)
DIFNEW= ABS(THRUST - ACTHST)
IF(DIFNEW.LE.DIFOLD)
F
T
GO TO 191
IF(I.LT.IMAX)
F
T
GO TO 181
GO TO 201
191
DIFOLD= DIFNEW
GO TO 171
44 J6
201
J1=JSAVE
T(1)=DATAB(6,J1)

CONT. ON PG 46

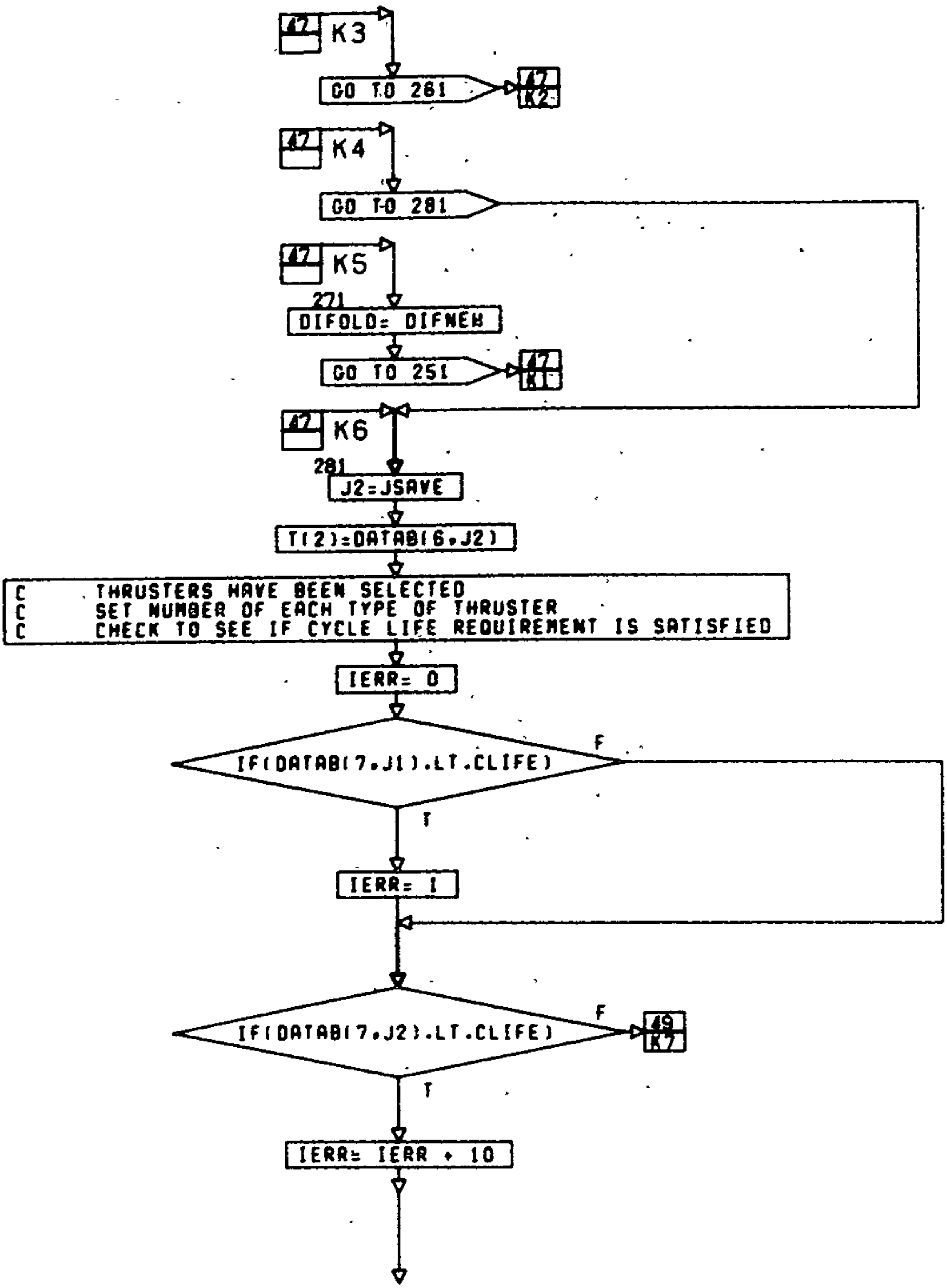

C SELECT PNEUMATIC TRANSLATIONAL THRUSTERS USING ABOVE PROCEDURE
I = 1
J2 = IDB(12) + 1
211
THRUST = DATAB(6,J2)
IF(THRUST.GE.TTHST)
F
T
GO TO 231
221
IF(J2.EQ.J1E)
F
T
GO TO 241
47
J9
J2 = J2 + 1
GO TO 211
231
IACCPT(I) = J2
I = I + 1
GO TO 221

CONT. ON PG 47



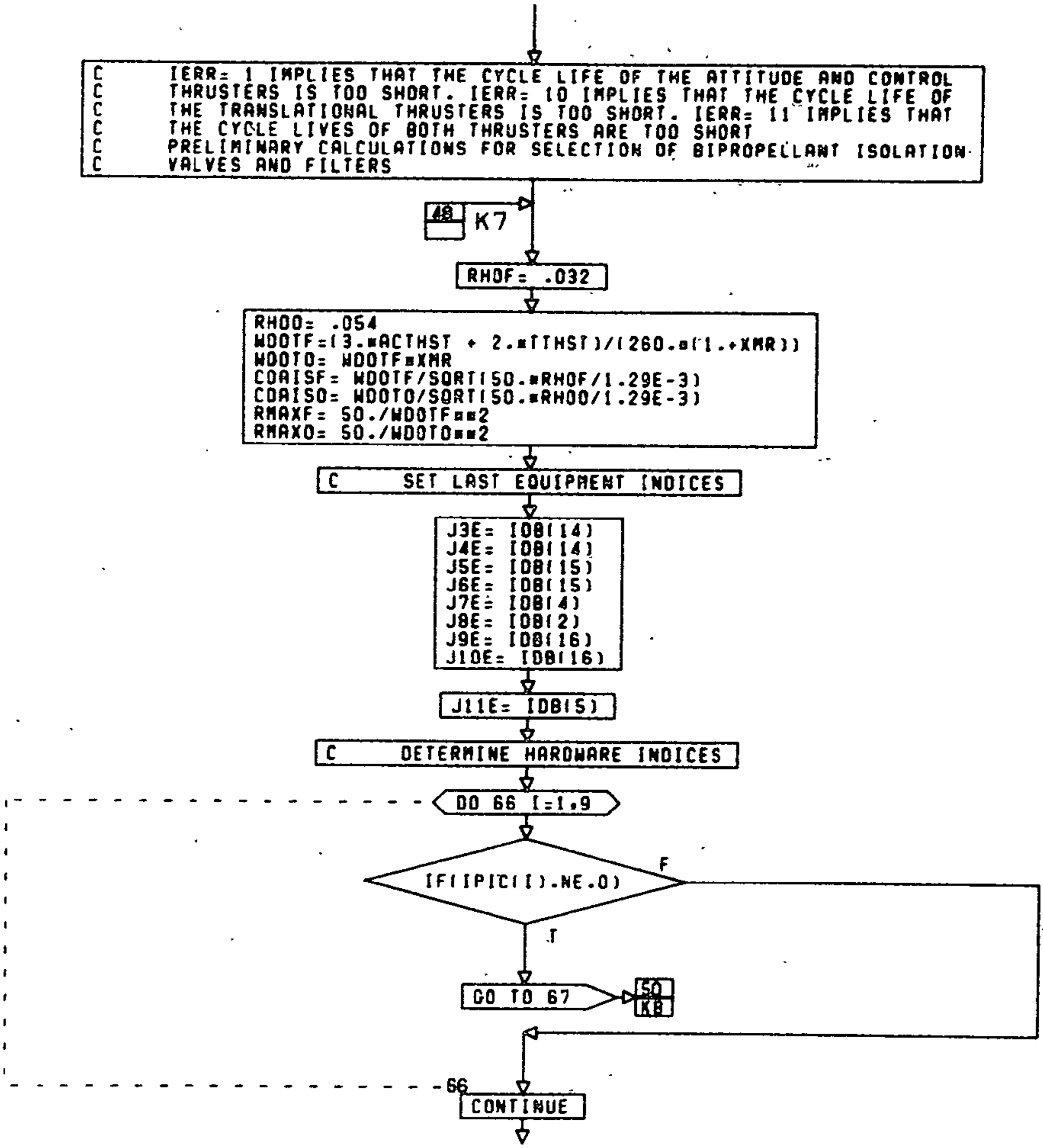
46
J9
241
CONTINUE
IMAX= I - 1
I= 1
J2= IACCPT(I)
THRUST= DATAB(6,J2)
DIFOLD= ABS(THRUST - TTHST)
K1
48
251
ICHOSE(2)= DATAB(1,J2)
JSAVE=J2
IF(I.EQ.IMAX)
F
T
GO TO 281
48
K6
K2
48
261
I= I + 1
J2= IACCPT(I)
THRUST= DATAB(6,J2)
DIFNEW= ABS(THRUST - TTHST)
IF(DIFNEW.LE.DIFOLD)
F
T
GO TO 271
48
K5
IF(I.LT.IMAX)
F
48
K4
T
48
K3

CONT. ON PG 48

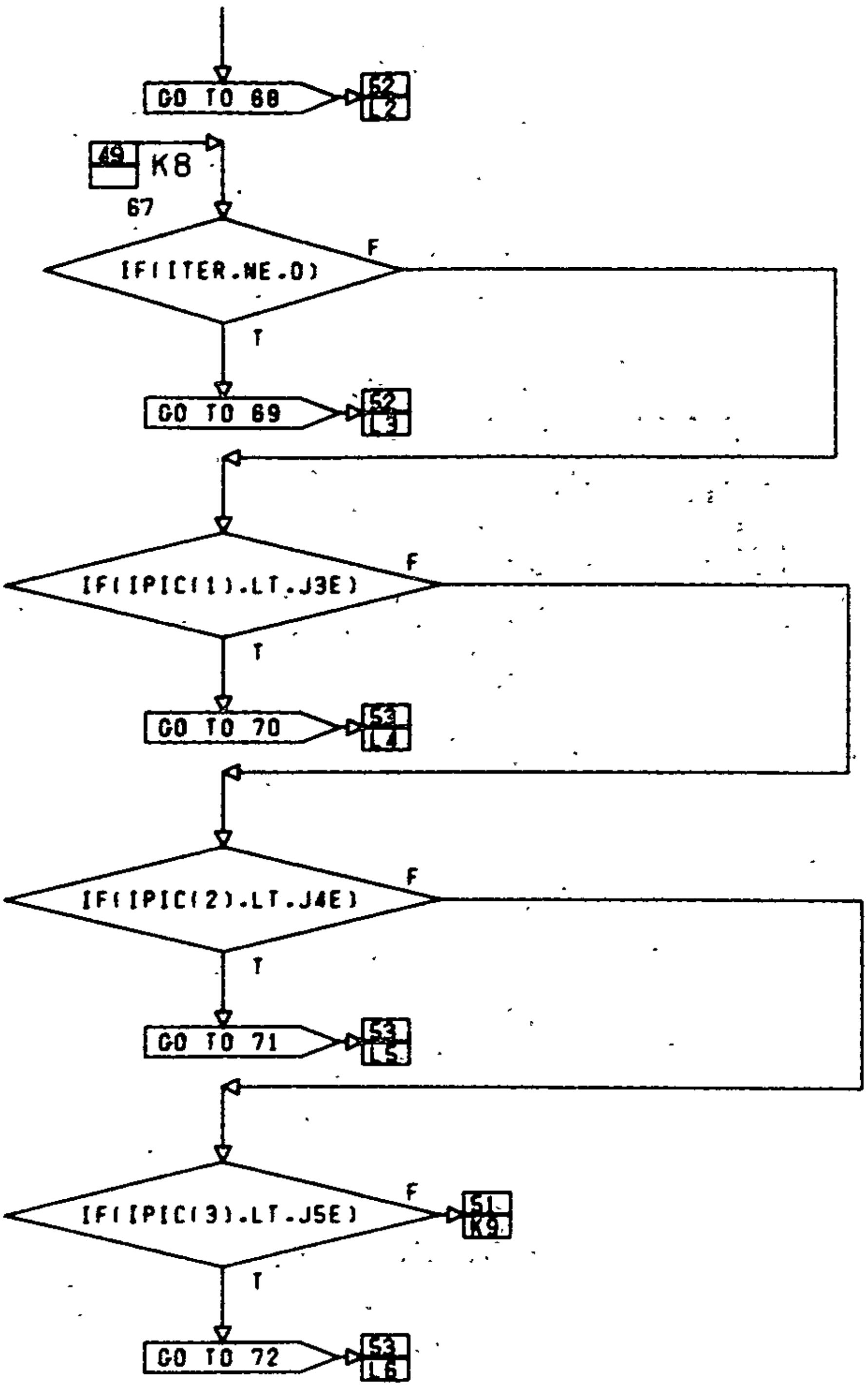


47 K3
GO TO 281
47 K2
47 K4
GO TO 281
47 K5
271
DIFOLD= DIFNEW
GO TO 251
47 K1
47 K6
281
J2=JSAVE
T(2)=DATAB(6,J2)
C THRUSTERS HAVE BEEN SELECTED
C SET NUMBER OF EACH TYPE OF THRUSTER
C CHECK TO SEE IF CYCLE LIFE REQUIREMENT IS SATISFIED
IERR= 0
IF(DATAB(7,J1).LT.CLIFE)
F
T
IERR= 1
IF(DATAB(7,J2).LT.CLIFE)
F
49 K7
T
IERR= IERR + 10

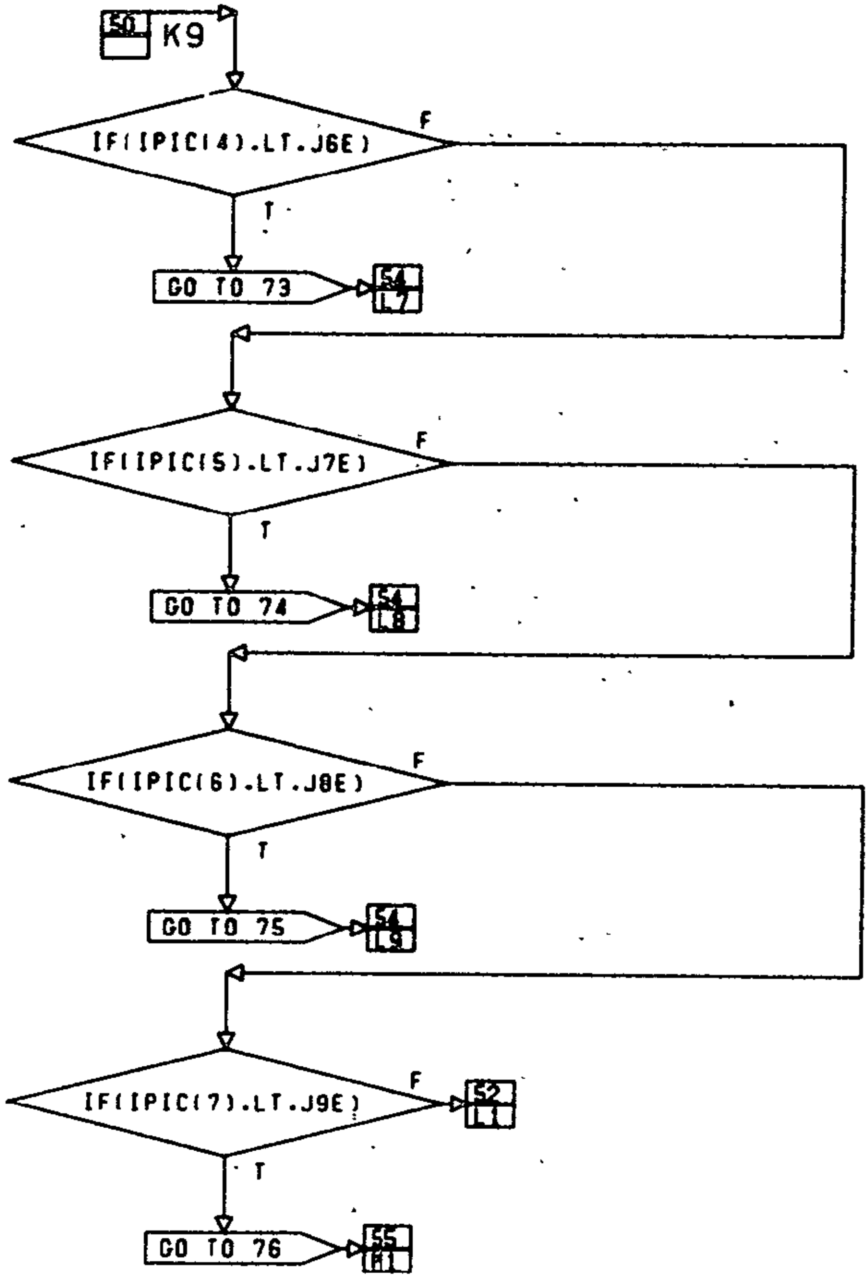
CONT. ON PG 49


C IERR= 1 IMPLIES THAT THE CYCLE LIFE OF THE ATTITUDE AND CONTROL
C THRUSTERS IS TOO SHORT. IERR= 10 IMPLIES THAT THE CYCLE LIFE OF
C THE TRANSLATIONAL THRUSTERS IS TOO SHORT. IERR= 11 IMPLIES THAT
C THE CYCLE LIVES OF BOTH THRUSTERS ARE TOO SHORT
C PRELIMINARY CALCULATIONS FOR SELECTION OF BIPROPELLANT ISOLATION
C VALVES AND FILTERS
48
K7
RHOF= .032
RHOO= .054
WDOTF=(3.*ACTHST + 2.*TTHST)/(260.*(1.+XMR))
WDOTO= WDOTF*XMR
CDAISF= WDOTF/SQRT(50.*RHOF/1.29E-3)
CDAISO= WDOTO/SQRT(50.*RHOO/1.29E-3)
RMAXF= 50./WDOTF**2
RMAXO= 50./WDOTO**2
C SET LAST EQUIPMENT INDICES
J3E= IDB(14)
J4E= IDB(14)
J5E= IDB(15)
J6E= IDB(15)
J7E= IDB(4)
J8E= IDB(2)
J9E= IDB(16)
J10E= IDB(16)
J11E= IDB(5)
C DETERMINE HARDWARE INDICES
DO 66 I=1,9
IF(IPIC(I).NE.0)
F
T
GO TO 67
50
K8
66
CONTINUE

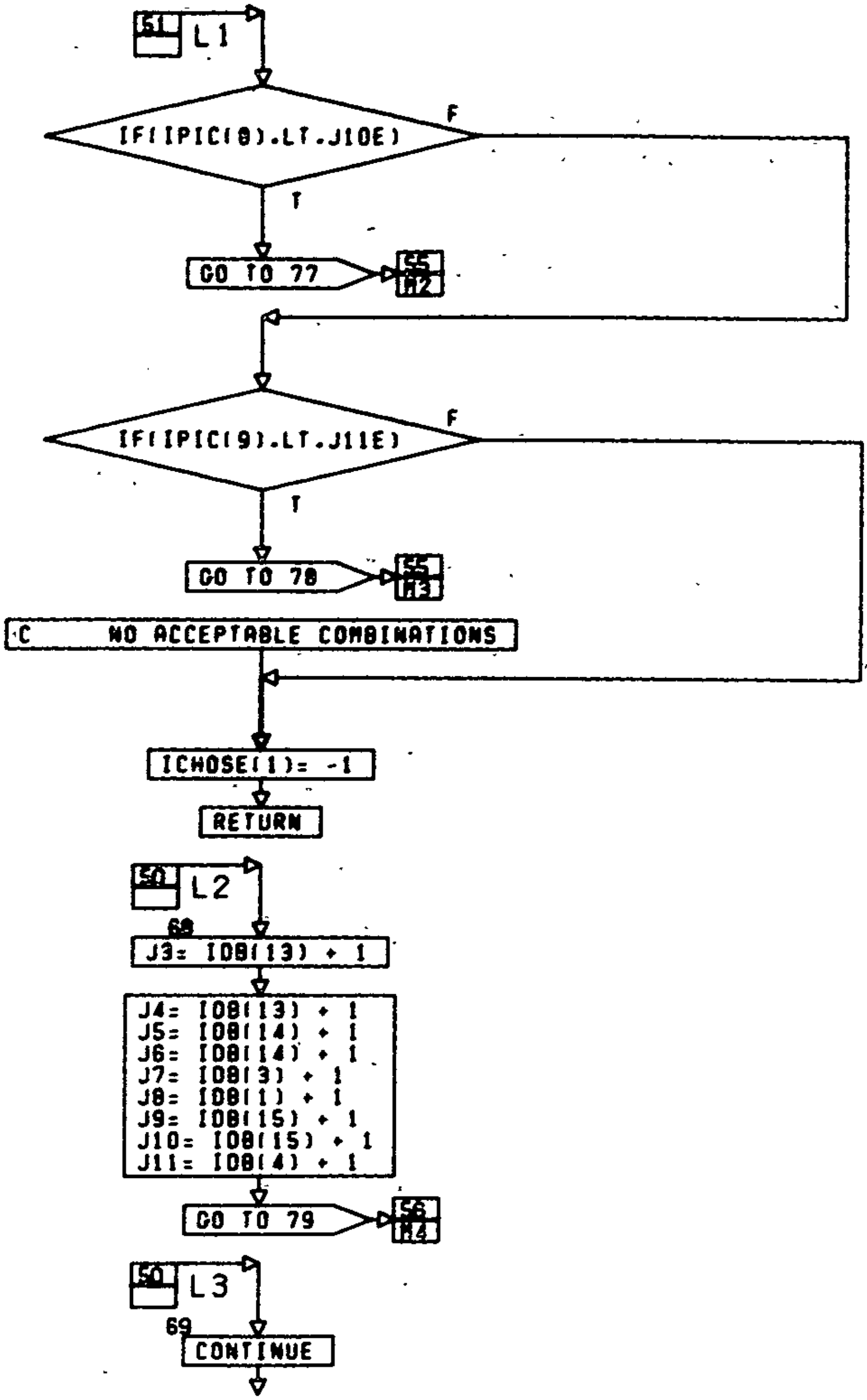
CONT. ON PG 50


GO TO 68
52
L2
49
K8
67
IF(ITER.NE.0)
F
T
GO TO 69
52
L3
IF(IPIC(1).LT.J3E)
F
T
GO TO 70
53
L4
IF(IPIC(2).LT.J4E)
F
T
GO TO 71
53
L5
IF(IPIC(3).LT.J5E)
F
51
K9
T
GO TO 72
53
L6

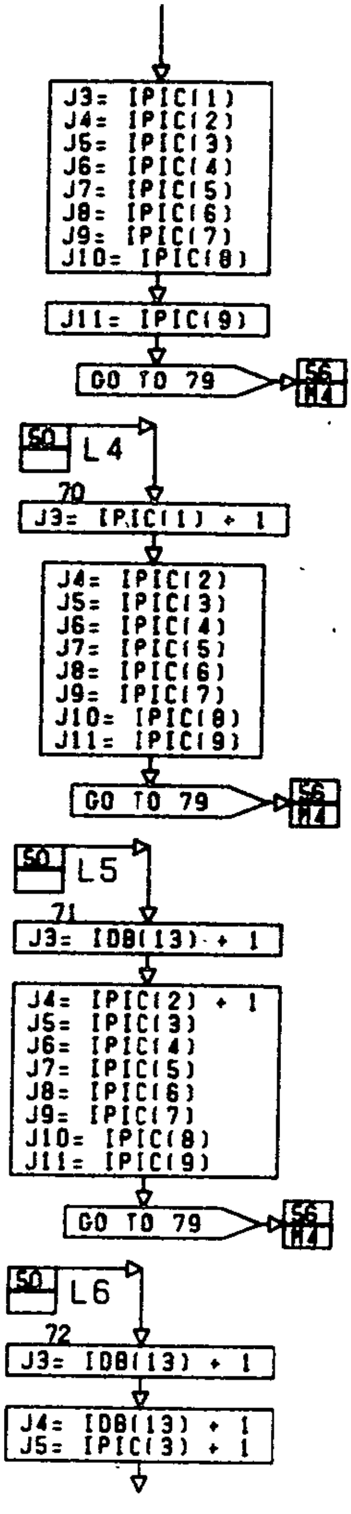
CONT. ON PG 51


50
K9
IF(IPIC(4).LT.J6E)
F
T
GO TO 73
54
L7
IF(IPIC(5).LT.J7E)
F
T
GO TO 74
54
L8
IF(IPIC(6).LT.J8E)
F
T
GO TO 75
54
L9
IF(IPIC(7).LT.J9E)
F
52
L1
T
GO TO 76
55
H1

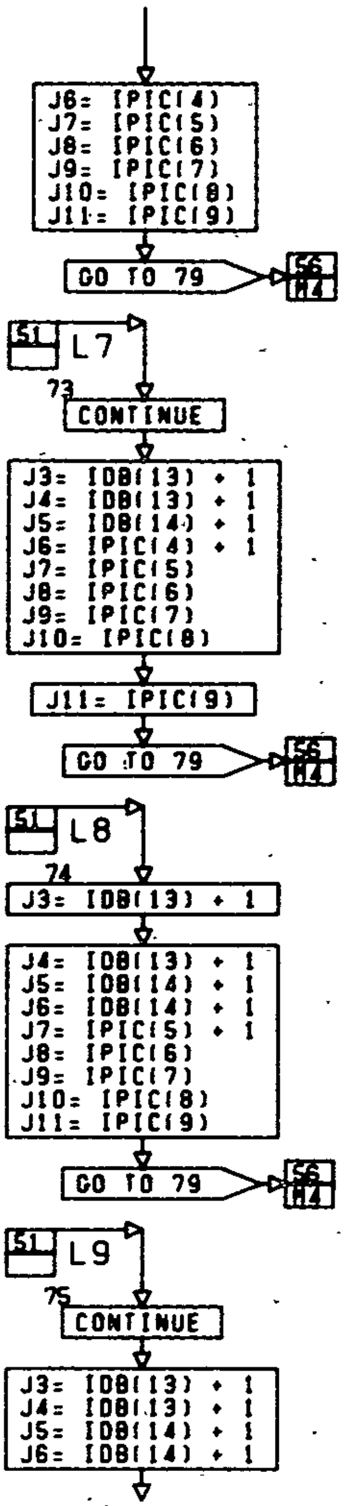
CONT. ON PG 52


51
L1
IF(IPIC(8).LT.J10E)
F
T
GO TO 77
55
M2
IF(IPIC(9).LT.J11E)
F
T
GO TO 78
55
M3
C NO ACCEPTABLE COMBINATIONS
ICHOSE(1)= -1
RETURN
50
L2
68
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= IDB(1) + 1
J9= IDB(15) + 1
J10= IDB(15) + 1
J11= IDB(4) + 1
GO TO 79
56
M4
50
L3
69
CONTINUE

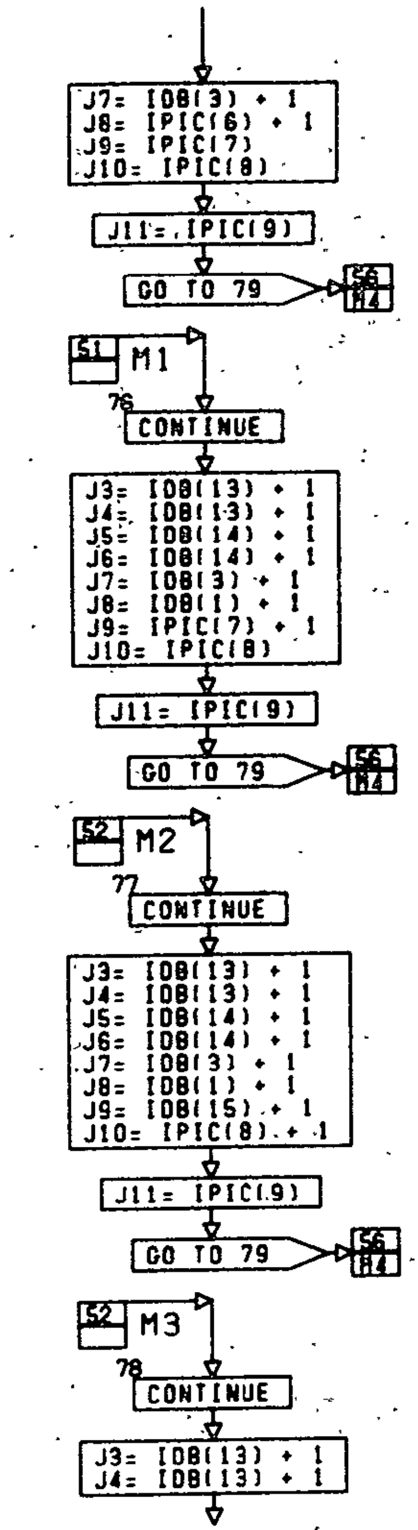
CONT. ON PG 53


J3= IPIC(1)
J4= IPIC(2)
J5= IPIC(3)
J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
J9= IPIC(7)
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
50
L4
70
J3= IPIC(1) + 1
J4= IPIC(2)
J5= IPIC(3)
J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
J9= IPIC(7)
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
50
L5
71
J3= IDB(13) + 1
J4= IPIC(2) + 1
J5= IPIC(3)
J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
J9= IPIC(7)
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
50
L6
72
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IPIC(3) + 1

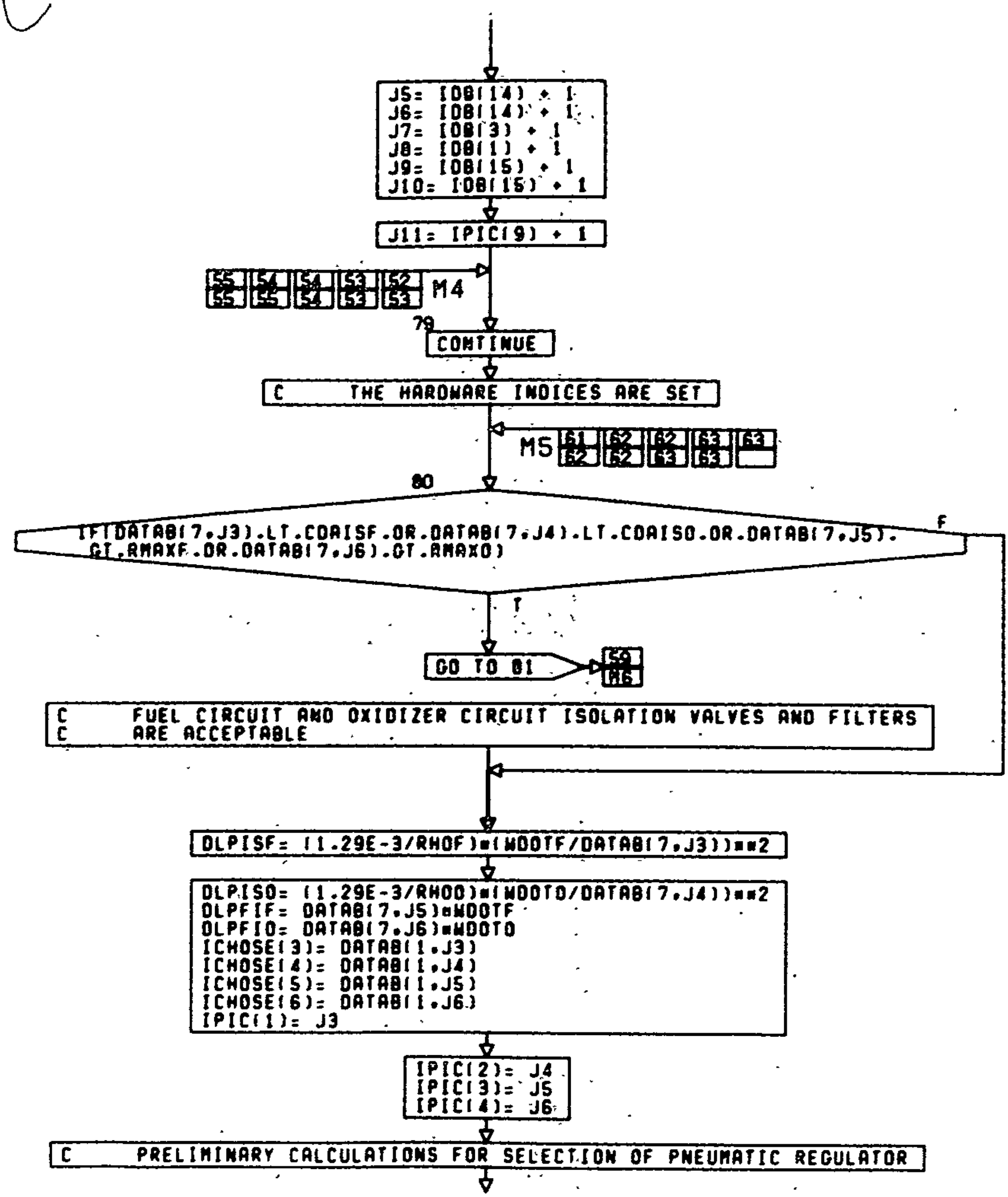
CONT. ON PG 54


J6= IPIC(4)
J7= IPIC(5)
J8= IPIC(6)
J9= IPIC(7)
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
51
L7
73
CONTINUE
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IPIC(4) + 1
J7= IPIC(5)
J8= IPIC(6)
J9= IPIC(7)
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
51
L8
74
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IPIC(5) + 1
J8= IPIC(6)
J9= IPIC(7)
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
51
L9
75
CONTINUE
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1

CONT. ON PG 55

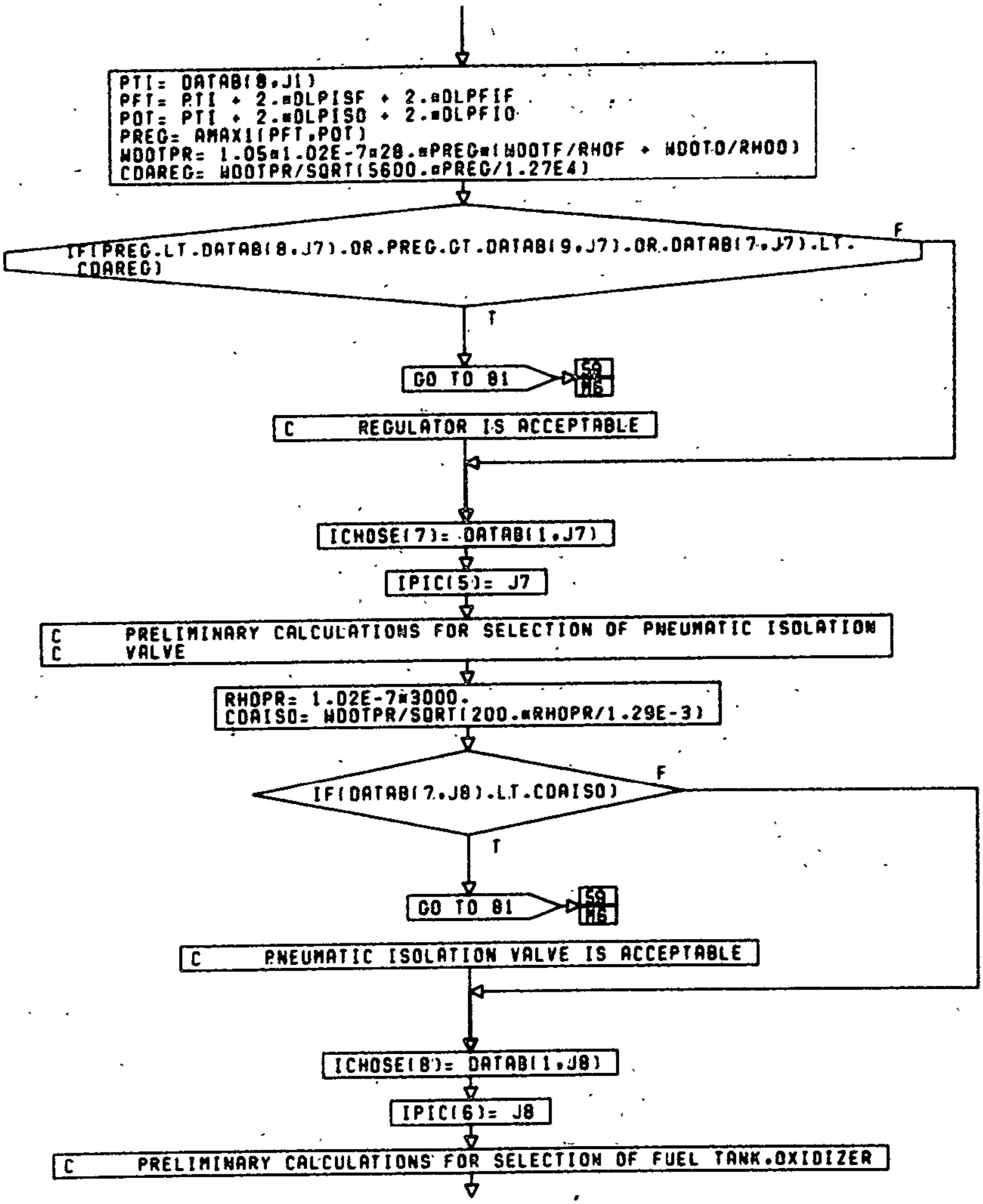

J7= IDB(3) + 1
J8= IPIC(6) + 1
J9= IPIC(7)
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
51
M1
76
CONTINUE
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= IDB(1) + 1
J9= IPIC(7) + 1
J10= IPIC(8)
J11= IPIC(9)
GO TO 79
56
M4
52
M2
77
CONTINUE
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= IDB(1) + 1
J9= IDB(15) + 1
J10= IPIC(8) + 1
J11= IPIC(9)
GO TO 79
56
M4
52
M3
78
CONTINUE
J3= IDB(13) + 1
J4= IDB(13) + 1

CONT. ON PG 56

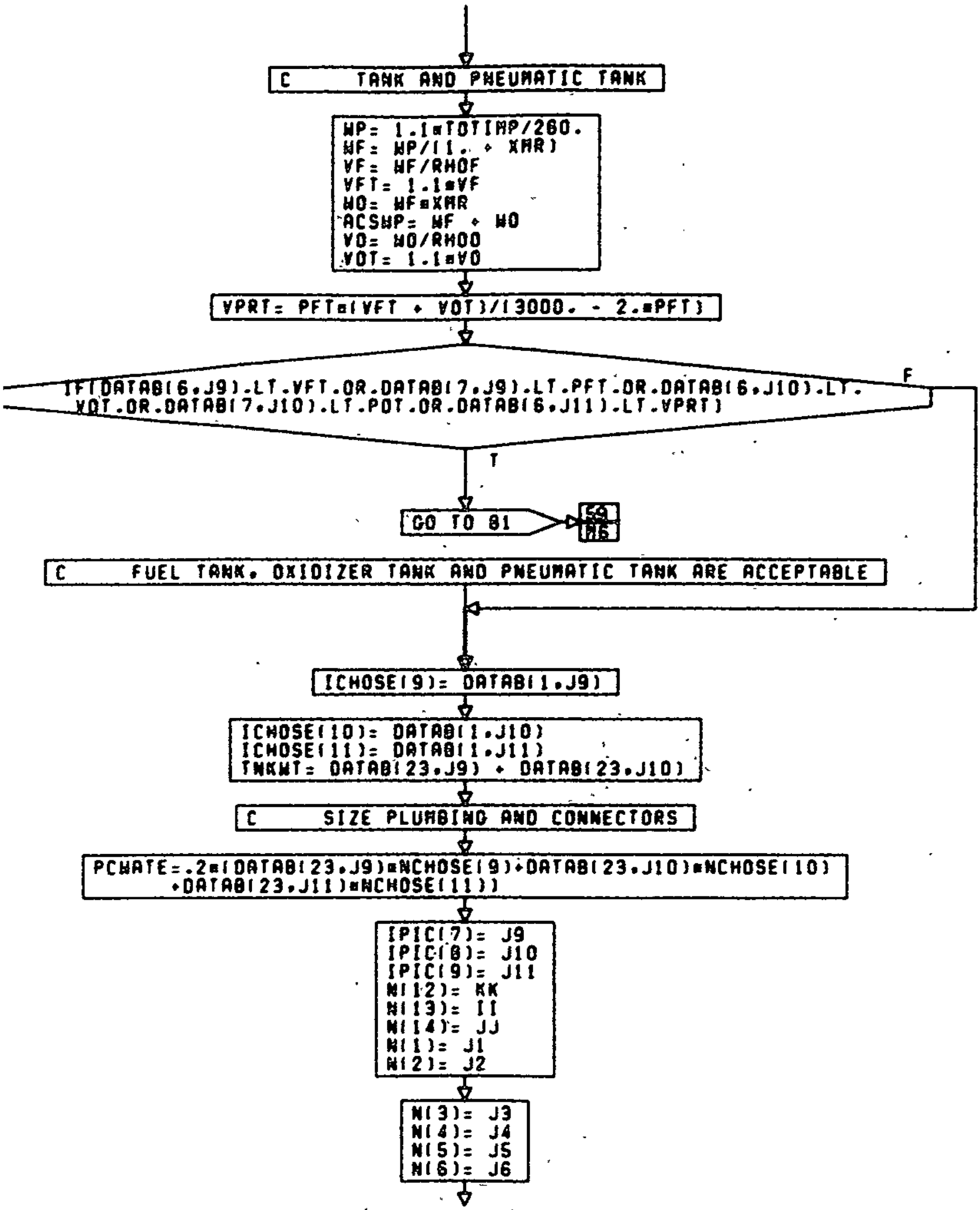


J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= IDB(1) + 1
J9= IDB(15) + 1
J10= IDB(15) + 1
J11= IPIC(9) + 1
M4
79
CONTINUE
C THE HARDWARE INDICES ARE SET
M5
80
IF(DATAB(7,J3).LT.CDAISF.OR.DATAB(7,J4).LT.CDAISO.OR.DATAB(7,J5).
GT.RMAXF.OR.DATAB(7,J6).GT.RMAXO)
F
T
GO TO 81
C FUEL CIRCUIT AND OXIDIZER CIRCUIT ISOLATION VALVES AND FILTERS
C ARE ACCEPTABLE
DLPISF= (1.29E-3/RHOF)*(WDOTF/DATAB(7,J3))**2
DLPISO= (1.29E-3/RHOO)*(WDOTO/DATAB(7,J4))**2
DLPFIF= DATAB(7,J5)*WDOTF
DLPFIO= DATAB(7,J6)*WDOTO
ICHOSE(3)= DATAB(1,J3)
ICHOSE(4)= DATAB(1,J4)
ICHOSE(5)= DATAB(1,J5)
ICHOSE(6)= DATAB(1,J6)
IPIC(1)= J3
IPIC(2)= J4
IPIC(3)= J5
IPIC(4)= J6
C PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC REGULATOR

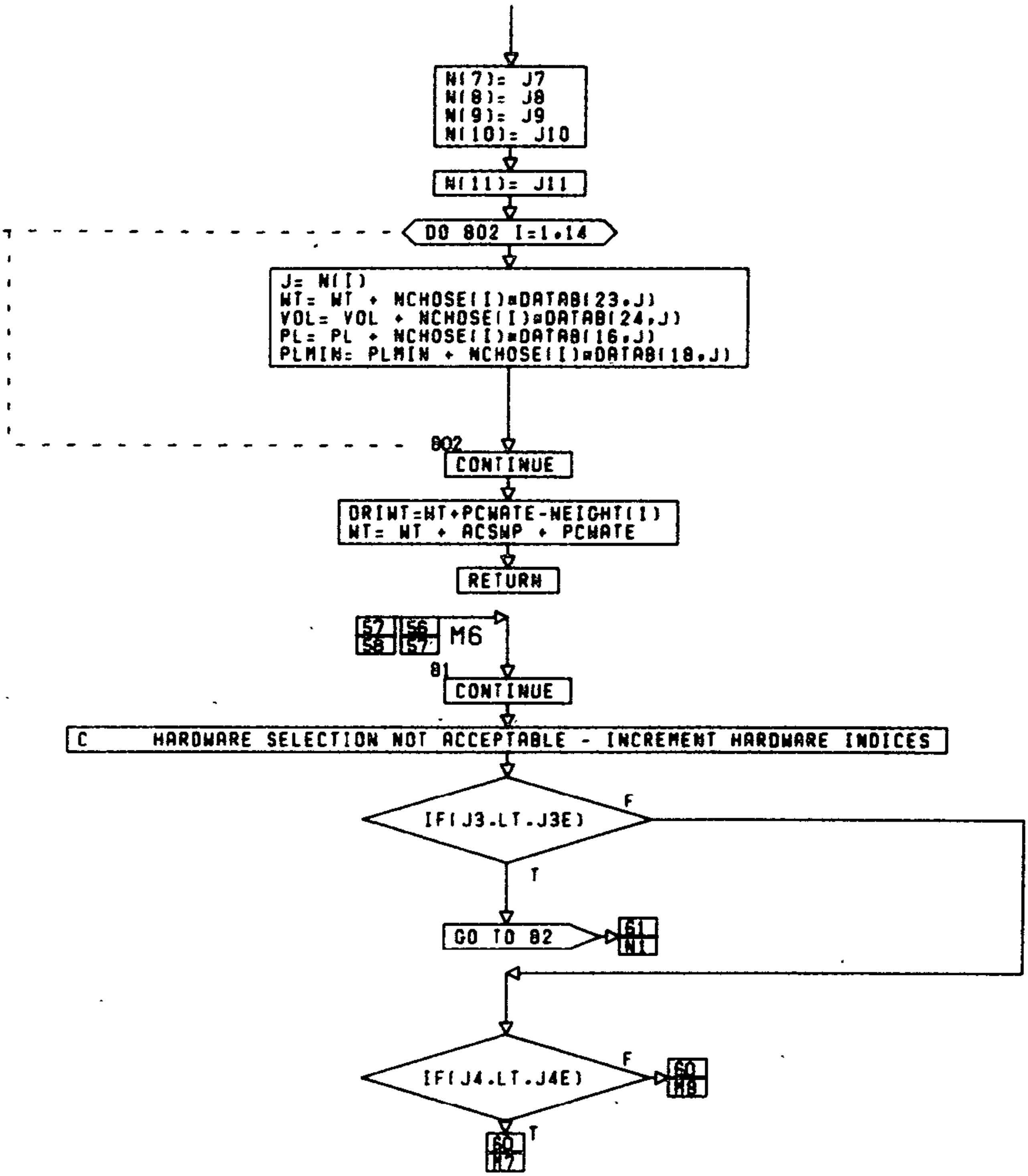
CONT. ON PG 57


PTI= DATAB(8,J1)
PFT= PTI + 2.*DLPISF + 2.*DLPFIF
POT= PTI + 2.*DLPISO + 2.*DLPFIO
PREG= AMAX1(PFT,POT)
WDOTPR= 1.05*1.02E-7*28.*PREG*(WDOTF/RHOF + WDOTO/RHOO)
CDAREG= WDOTPR/SQRT(5600.*PREG/1.27E4)
IF(PREG.LT.DATAB(8,J7).OR.PREG.GT.DATAB(9,J7).OR.DATAB(7,J7).LT.
CDAREG)
F
T
GO TO 81
59
M6
C REGULATOR IS ACCEPTABLE
ICHOSE(7)= DATAB(1,J7)
IPIC(5)= J7
C PRELIMINARY CALCULATIONS FOR SELECTION OF PNEUMATIC ISOLATION
C VALVE
RHOPR= 1.02E-7*3000.
CDAISO= WDOTPR/SQRT(200.*RHOPR/1.29E-3)
IF(DATAB(7,J8).LT.CDAISO)
F
T
GO TO 81
59
M6
C PNEUMATIC ISOLATION VALVE IS ACCEPTABLE
ICHOSE(8)= DATAB(1,J8)
IPIC(6)= J8
C PRELIMINARY CALCULATIONS FOR SELECTION OF FUEL TANK,OXIDIZER

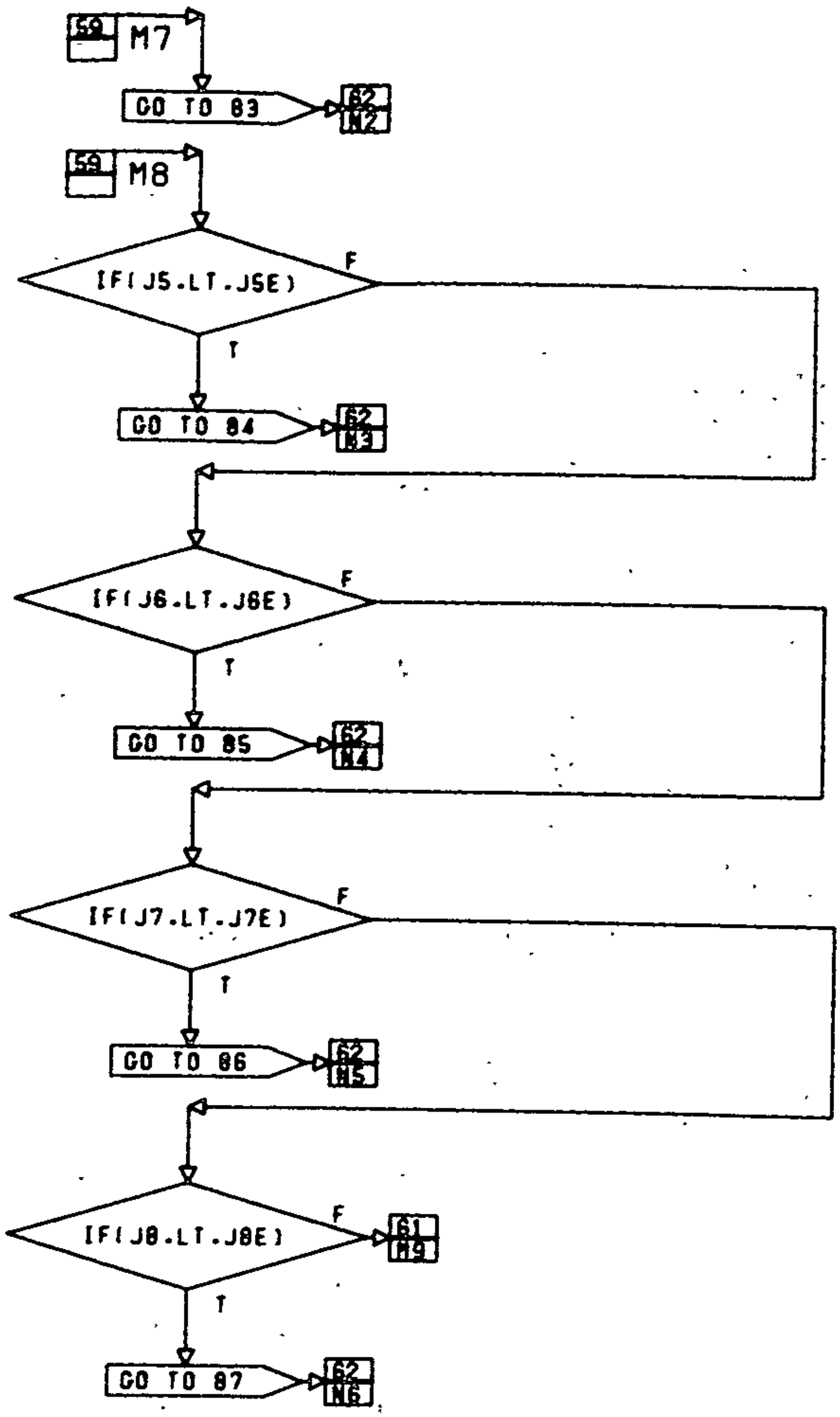
CONT. ON PG 58


C TANK AND PNEUMATIC TANK
WP= 1.1*TOTIMP/260.
WF= WP/(1. + XMR)
VF= WF/RHOF
VFT= 1.1*VF
WO= WF*XMR
ACSWP= WF + WO
VO= WO/RHOO
VOT= 1.1*VO
VPRT= PFT*(VFT + VOT)/(3000. - 2.*PFT)
IF(DATAB(6,J9).LT.VFT.OR.DATAB(7,J9).LT.PFT.OR.DATAB(6,J10).LT.
VOT.OR.DATAB(7,J10).LT.POT.OR.DATAB(6,J11).LT.VPRT)
F
T
GO TO 81
59
H6
C FUEL TANK, OXIDIZER TANK AND PNEUMATIC TANK ARE ACCEPTABLE
ICHOSE(9)= DATAB(1,J9)
ICHOSE(10)= DATAB(1,J10)
ICHOSE(11)= DATAB(1,J11)
TNKWT= DATAB(23,J9) + DATAB(23,J10)
C SIZE PLUMBING AND CONNECTORS
PCWATE=.2*(DATAB(23,J9)*NCHOSE(9)+DATAB(23,J10)*NCHOSE(10)
+DATAB(23,J11)*NCHOSE(11))
IPIC(7)= J9
IPIC(8)= J10
IPIC(9)= J11
N(12)= KK
N(13)= II
N(14)= JJ
N(1)= J1
N(2)= J2
N(3)= J3
N(4)= J4
N(5)= J5
N(6)= J6

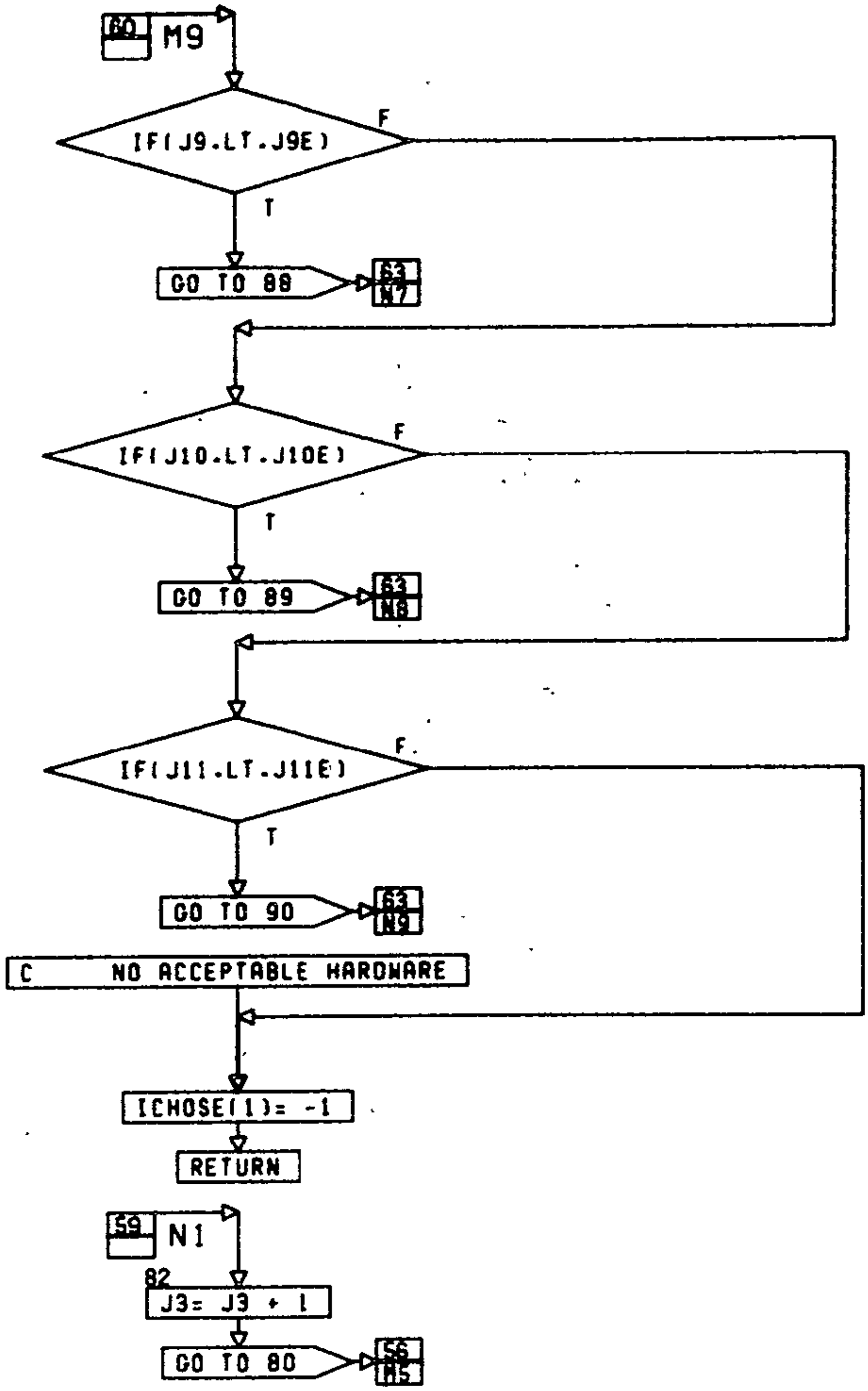
CONT. ON PG 59


N(7)= J7
N(8)= J8
N(9)= J9
N(10)= J10
N(11)= J11
DO 802 I=1,14
J= N(I)
WT= WT + NCHOSE(I)*DATAB(23,J)
VOL= VOL + NCHOSE(I)*DATAB(24,J)
PL= PL + NCHOSE(I)*DATAB(16,J)
PLMIN= PLMIN + NCHOSE(I)*DATAB(18,J)
802
CONTINUE
DRINT=WT+PCWATE-WEIGHT(I)
WT= WT + ACSWP + PCWATE
RETURN
57
58
56
57
M6
81
CONTINUE
C HARDWARE SELECTION NOT ACCEPTABLE - INCREMENT HARDWARE INDICES
IF(J3.LT.J3E)
F
T
GO TO 82
61
N1
IF(J4.LT.J4E)
F
60
N8
T
60
N7

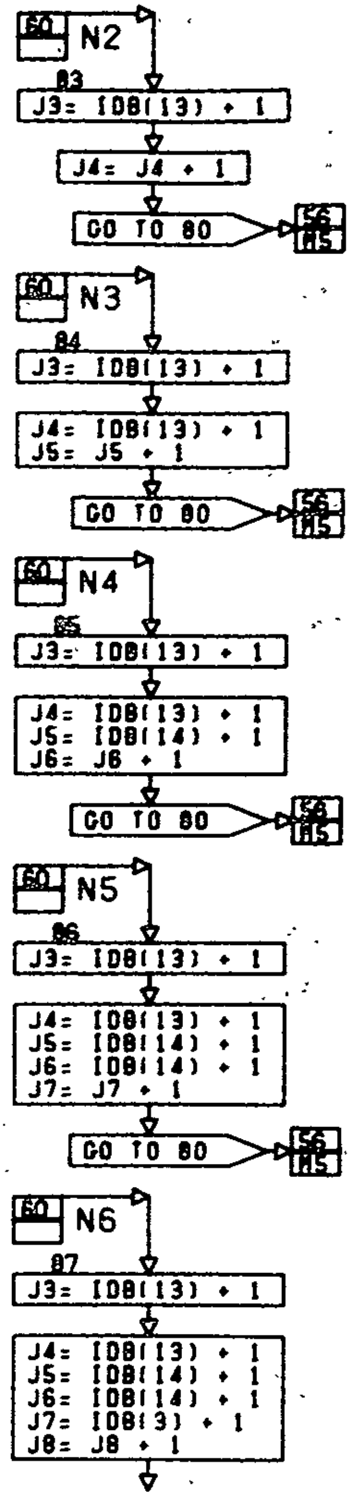
CONT. ON PG 60


59
M7
GO TO 83
62
N2
59
M8
IF(J5.LT.J5E)
F
T
GO TO 84
62
N3
IF(J6.LT.J6E)
F
T
GO TO 85
62
N4
IF(J7.LT.J7E)
F
T
GO TO 86
62
N5
IF(J8.LT.J8E)
F
61
M9
T
GO TO 87
62
N6

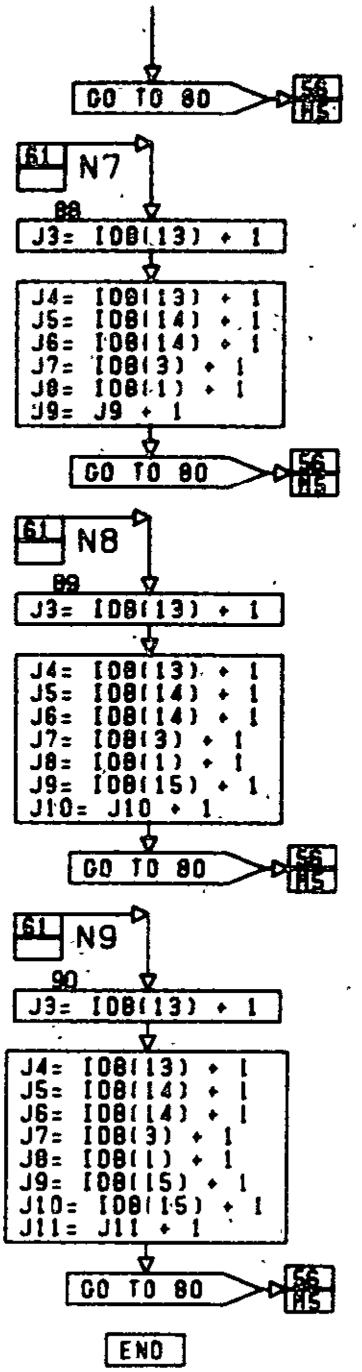
CONT. ON PG 61


60
M9
IF(J9.LT.J9E)
F
T
GO TO 88
63
N7
IF(J10.LT.J10E)
F
T
GO TO 89
63
N8
IF(J11.LT.J11E)
F
T
GO TO 90
63
N9
C NO ACCEPTABLE HARDWARE
ICHOSE(1)= -1
RETURN
59
N1
82
J3= J3 + 1
GO TO 80
56
M5

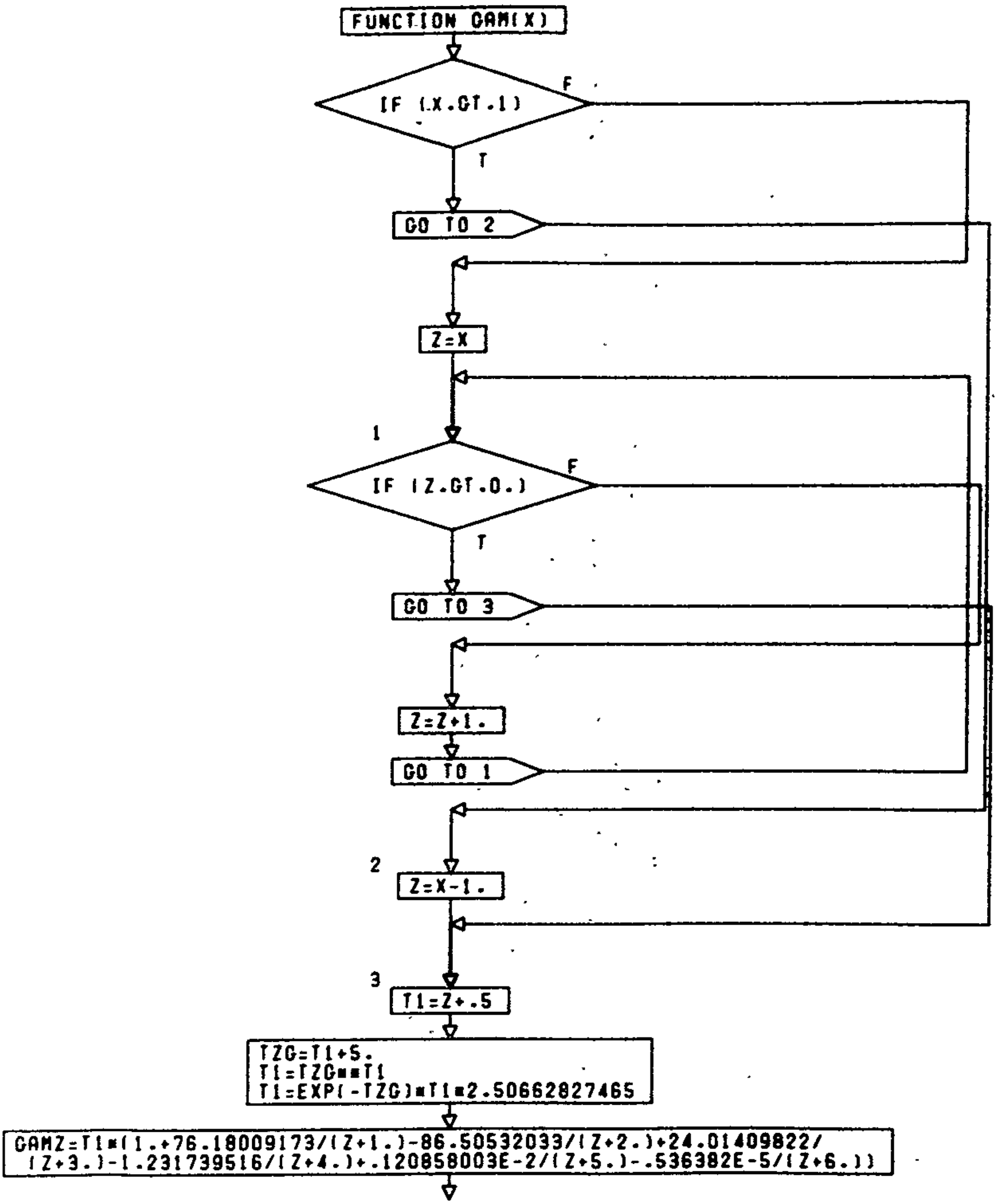
CONT. ON PG 62


60
N2
83
J3= IDB(13) + 1
J4= J4 + 1
GO TO 80
56
M5
60
N3
84
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= J5 + 1
GO TO 80
56
M5
60
N4
85
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= J6 + 1
GO TO 80
56
M5
60
N5
86
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= J7 + 1
GO TO 80
56
M5
60
N6
87
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= J8 + 1

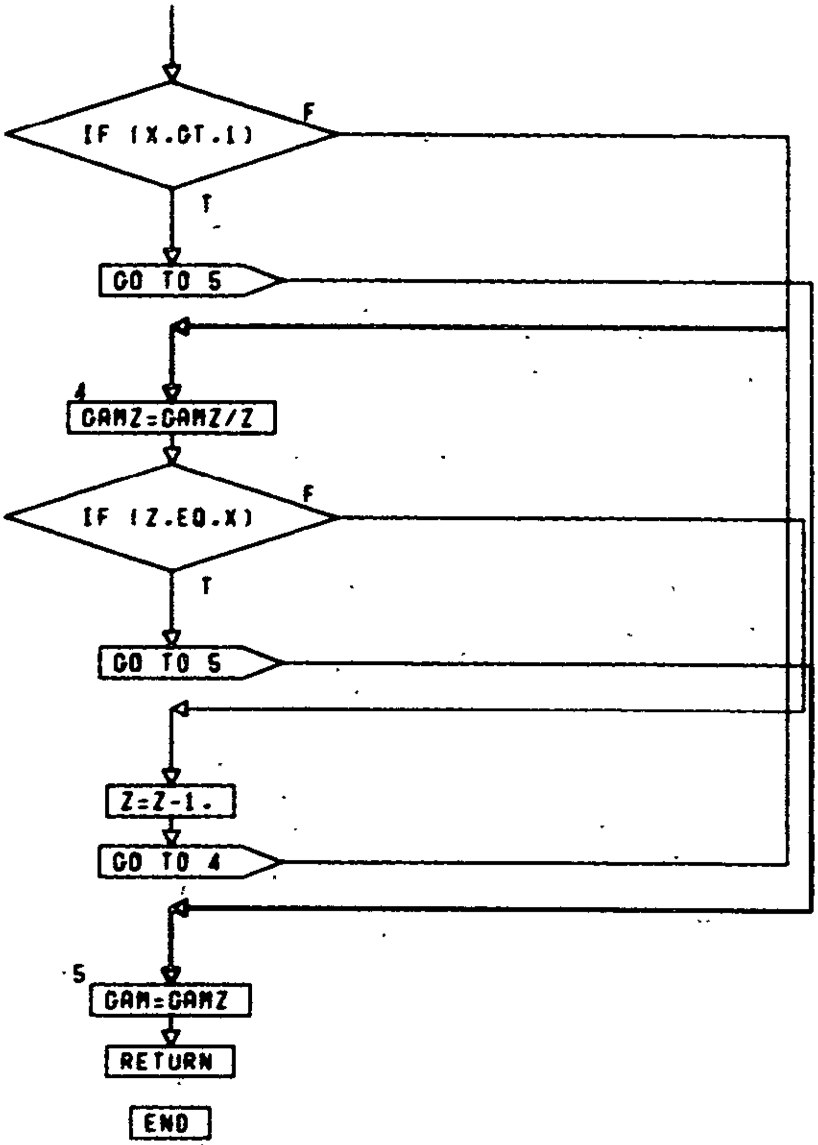
CONT. ON PG 63


GO TO 80
56
M5
61
N7
88
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= IDB(1) + 1
J9= J9 + 1
GO TO 80
56
M5
61
N8
89
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= IDB(1) + 1
J9= IDB(15) + 1
J10= J10 + 1
GO TO 80
56
M5
61
N9
90
J3= IDB(13) + 1
J4= IDB(13) + 1
J5= IDB(14) + 1
J6= IDB(14) + 1
J7= IDB(3) + 1
J8= IDB(1) + 1
J9= IDB(15) + 1
J10= IDB(15) + 1
J11= J11 + 1
GO TO 80
56
M5
END

PG 63 FINAL

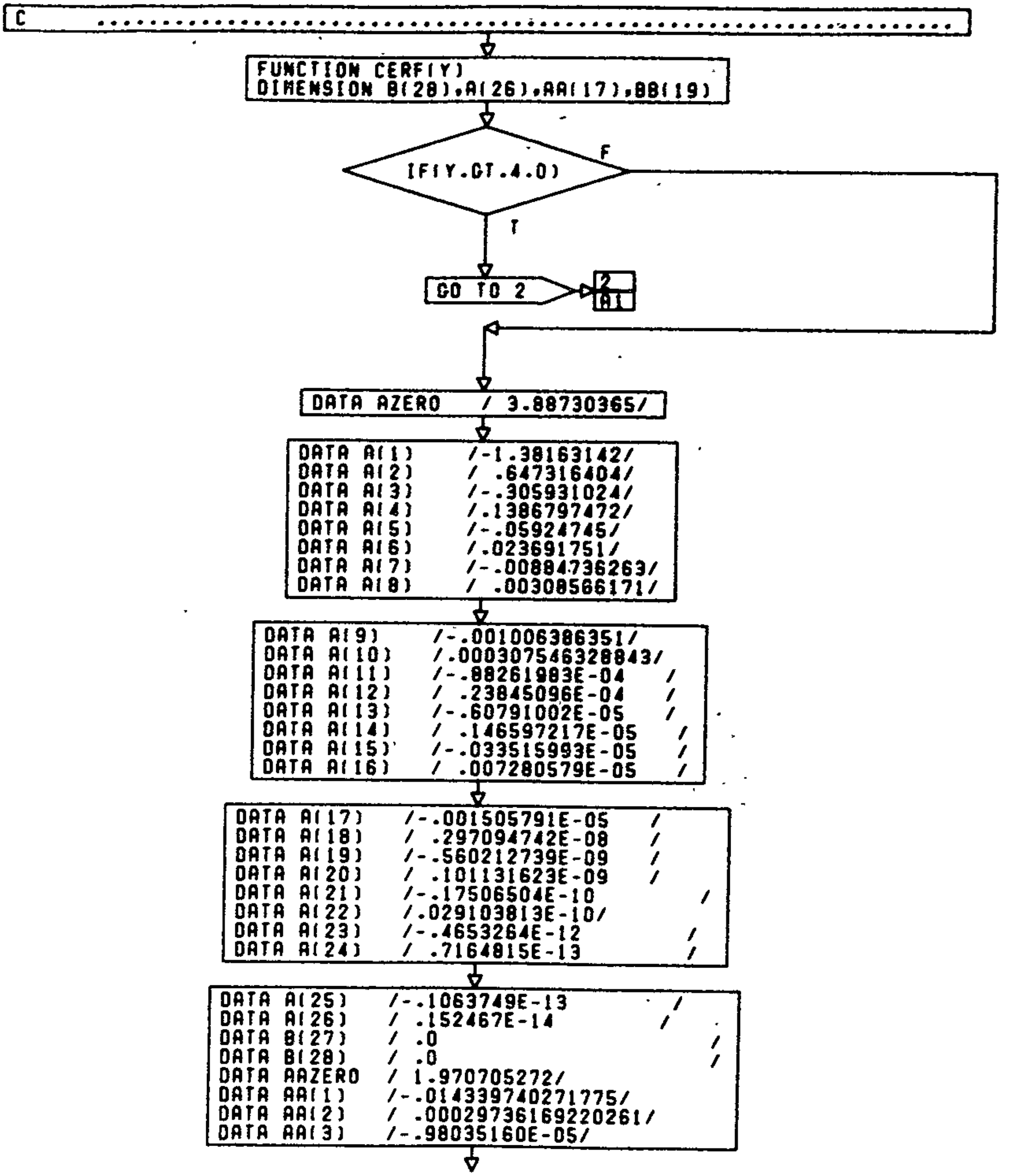

FUNCTION GAM(X)
IF (X.GT.1)
F
T
GO TO 2
Z=X
1
IF (Z.GT.0.)
F
T
GO TO 3
Z=Z+1.
GO TO 1
2
Z=X-1.
3
T1=Z+.5
TZG=T1+5.
T1=TZG**T1
T1=EXP(-TZG)*T1*2.50662827465
GAMZ=T1*(1.+76.18009173/(Z+1.)-86.50532033/(Z+2.)+24.01409822/
(Z+3.)-1.231739516/(Z+4.)+.120858003E-2/(Z+5.)-.536382E-5/(Z+6.))

CONT. ON PG 2

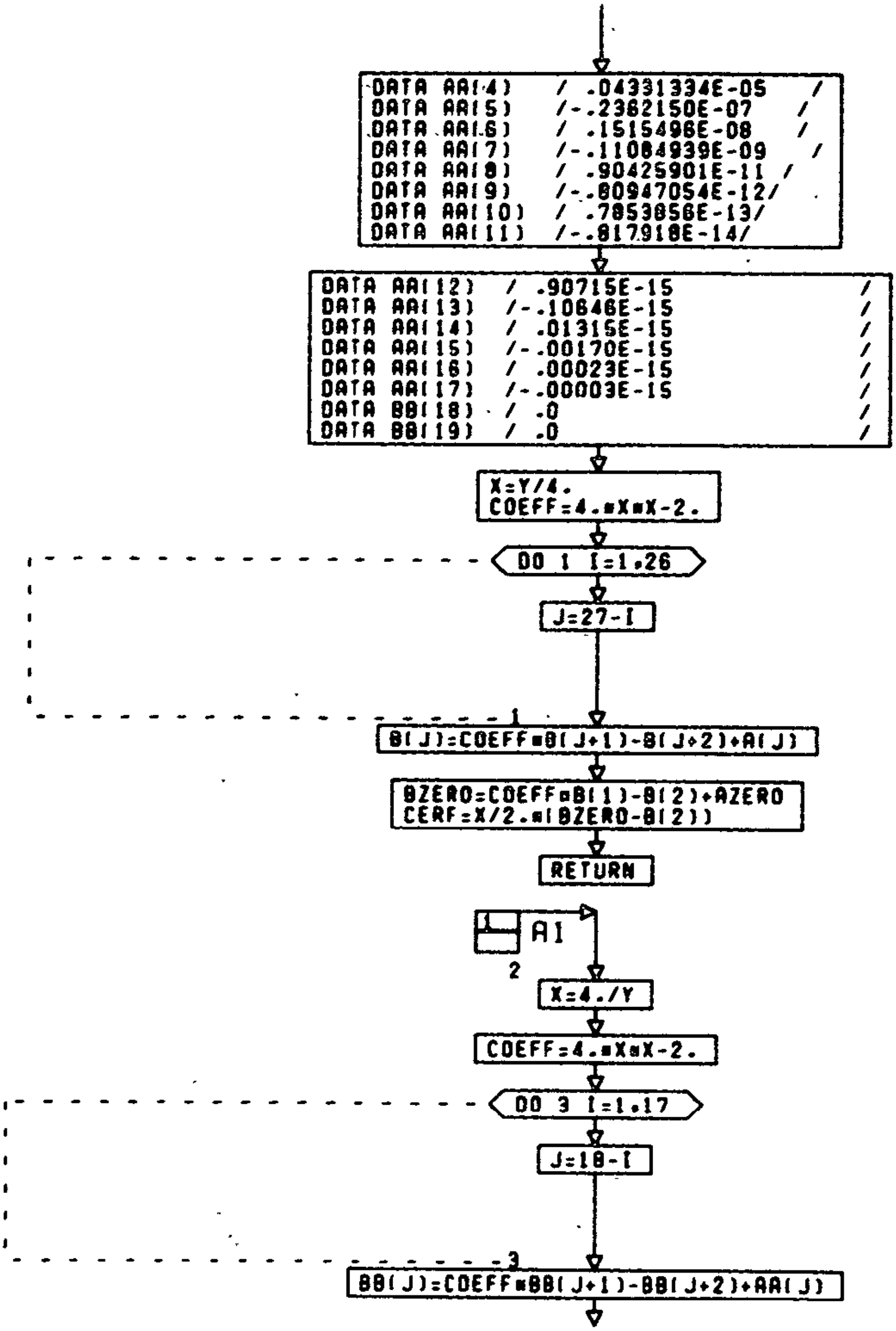


IF (X.GT.1)
F
T
GO TO 5
4
GAMZ=GAMZ/Z
IF (Z.EQ.X)
F
T
GO TO 5
Z=Z-1.
GO TO 4
5
GAM=GAMZ
RETURN
END

PG 2 FINAL


C ....
FUNCTION CERF(Y)
DIMENSION B(28),A(26),AA(17),BB(19)
IF(Y.GT.4.0)
F
T
GO TO 2
2
A1
DATA AZERO / 3.88730365/
DATA A(1) /-1.38163142/
DATA A(2) / .647316404/
DATA A(3) /-.305931024/
DATA A(4) /.1386797472/
DATA A(5) /-.05924745/
DATA A(6) /.023691751/
DATA A(7) /-.00884736263/
DATA A(8) / .00308566171/
DATA A(9) /-.001006386351/
DATA A(10) /.000307546328843/
DATA A(11) /-.88261983E-04 /
DATA A(12) / .23845096E-04 /
DATA A(13) /-.60791002E-05 /
DATA A(14) / .146597217E-05 /
DATA A(15) /-.033515993E-05 /
DATA A(16) / .007280579E-05 /
DATA A(17) /-.001505791E-05 /
DATA A(18) / .297094742E-08 /
DATA A(19) /-.560212739E-09 /
DATA A(20) / .101131623E-09 /
DATA A(21) /-.17506504E-10 /
DATA A(22) /.029103813E-10/
DATA A(23) /-.4653264E-12 /
DATA A(24) / .7164815E-13 /
DATA A(25) /-.1063749E-13 /
DATA A(26) / .152467E-14 /
DATA B(27) / .0 /
DATA B(28) / .0 /
DATA AAZERO / 1.970705272/
DATA AA(1) /-.014339740271775/
DATA AA(2) / .00029736169220261/
DATA AA(3) /-.98035160E-05/

CONT. ON PG 2


DATA AA(4) / .04331334E-05 /
DATA AA(5) /-.2362150E-07 /
DATA AA(6) / .1515496E-08 /
DATA AA(7) /-.11084939E-09 /
DATA AA(8) / .90425901E-11 /
DATA AA(9) /-.809470S4E-12/
DATA AA(10) / .7853856E-13/
DATA AA(11) /-.817918E-14/
DATA AA(12) / .90715E-15 /
DATA AA(13) /-.10846E-15 /
DATA AA(14) / .01315E-15 /
DATA AA(15) /-.00170E-15 /
DATA AA(16) / .00023E-15 /
DATA AA(17) /-.00003E-15 /
DATA BB(18) / .0 /
DATA BB(19) / .0 /
X=Y/4.
COEFF=4.*X*X-2.
DO 1 I=1,26
J=27-I
1
B(J)=COEFF*B(J+1)-B(J+2)+A(J)
BZERO=COEFF*B(1)-B(2)+AZERO
CERF=X/2.*(BZERO-B(2))
RETURN
1
AI
2
X=4./Y
COEFF=4.*X*X-2.
DO 3 I=1,17
J=18-I
3
BB(J)=COEFF*BB(J+1)-BB(J+2)+AA(J)

CONT. ON PG 3

```
BBZERO=COEFF*BB(1)-BB(2)+AAZERO
CERF=(BBZERO-BB(2))/(2.*Y*EXP(Y*Y))*.564189583547756
```

```
RETURN
```

```
END
```

PG 3 FINAL

```
C       .......................................................................
```

```
SUBROUTINE RELY (IRTN,IDS,NEQUIP)
COMMON /USERR/     ISPT,       ISUB,      KEOPT,     RFIXED,     SLBMX
```

```
COMMON /USERI/    APOGEE,    COMRAT,    DIAMAX, EEQWT(9),     EPME,
                  EQM1WT,    EQM1XL,    EQM1YL,   EQM1ZL,   EQM2WT,
                  EQM2XL,    EQM2YL,    EQM2ZL,       FE,   IAGNCY,
        IDEBUG,   ISATOR,    MB12SH,       TBI,   ORBINC,   PERIGE,
         MICRO,     RFNL,   SPEC(6),      CONS,        T,   XCGSAI,
                    XMER,      XMEU
```

```
COMMON /BTWN/      ACSSN,     ACSWP,       ALT,     AREA,   BATCAP,
               BITRAT(2),     CLIFE,    CONVWT,    XDUM2,       DT,
                      DX,        DY,        DZ,    EQBLG,   EQBSID,
                      FC,        FF,    HARNWT,      HPT,   HTPIPE,
                    HTPT,    HTRPRB,    HTRPWR,             IBTLOC,
                       D,        NC,    OMEGS,    PASSTR,       PJ,
                      PL,     PLMIN,    POCNWT,     RADA,    RADAB,
                     RAT,        RJ,    SABOLG,    SATLG,   SATTWT,
```

```
                   SATWT,    SATXCG,    SATYCG,   SATZCG,    SAIXL,
                   SAIYL,     SAIZL,      SIDE,    SYSLB,   THCMWT,
               THRUST(2),        TI,     TNKWT,    TPRIM,       VB,
                    VCHP,       VOL,      WATE,       WB,      WBT,
                      WT,        XJ,     WZERO,       YJ,       ZJ
```

```
COMMON /DBCOM/ R(31),NR(60),RI(31,60),Z(31),RD(31),RDUM(31),
               SAVR(31),SAVNRW(31),RNEW(31),NMX(60),SAVMX(60),
               COST(60),DUM(3213)
```

```
COMMON /CHOSE/     COSTM(5,60),      OPIA(11,60),     ICHOSE(60),
                   NCHOSE(60),    DATAB ( 6,60),     SKD(7,60),
                   THM(4,60)
```

```
COMMON/PRTCOM/   ACCRCY,        AM,        AN,        BF,       BS,
              COPI(7,2),    CISTAR,      CTOT,      DOTE,       DE,
                  DRIWT,    EQBSTR,    FEEINV,    FEEOPS,     FEER,
                    GSE,      IREL,    ITRUNC,   MMDOLO,NAME(3,60),
                    OPS,    PAYINV,    PAYOUL,      PAYR,       PE,
                    PMP,       PMR,  POWER(6),        PU,  PWR(60),
                    OCP,       OCR,  ROLD(60),    SABMWT,   SATADP,
                 SATINV,      SATR,      SEIP,      SEIR, SKTAU(6),
```

```
               SSREL(6),   SUBE(7),   SUBT(7),  SUBUE(7),  SUBUP(7),
                     TA, TAU(6,6),     XDUM1,        TC,       TE,
                     TF,     TOOLR,     TOOLU,    TOTOPS,    TRUNC,
                     TS,       TTT,VOLUME(6),   VOL(60),WEIGHT(6),
                  XLTOT,      XMEH,    XMEINV,      XMEL,    XMEVL,
                   XMEW,     XMEWT,     XVEST
```

```
DIMENSION N(5),NEQUIP(5)
REAL MMDOLO,MMDNEW,LAMS,NZERO
INTEGER SAVMX,SAVNSR
```

CONT. ON PG 2

```
C     ..........................................................................
C                                         INITIAL
C          VARIABLES         SIZE         ORIGIN-         DEFN
C                                         CHANGE
C             NSMX             1          EXT-NC          MAX NUM SYSTEM REDUNDANCIES
C             NSR              1          EXT- C          CURRENT NUM OF SYSTEM
C                                                         REDUNDANCIES
C             IRTN             1          EXT-NC          RETURN INDICATOR
```

```
C             JMIN             1          EXT-NC          LOWER LIMIT ON MODULE NUM
C             JMAX             1          EXT-NC          UPPER LIMIT ON MODULE NUM
C             NR            N(NSS)        EXT- C          CURRENT NUM OF REDUNDANCIES IN
C                                                         MODULE J
C             NMX           N(NSS)        EXT-NC          MAX NUM REDUNDANCIES IN MODULE
C                                                         J
C                                                         =1          R(TRUNC) MODE
C             NT               1          EXT-NC          LOOP AND OPTION PARAMETER
```

```
C            DELH              1          EXT-NC          TIME INCREMENT
C           ITRUNC             1          EXT-NC          NUM OF  TIME  POINTS
C              R            ITRUNC          INT           RELIABILITY FNC FOR MODULE J
C                                                         =ITRUNC      MMD MODE
C            ROLD           ITRUNC        EXT- C          PREVIOUS VALUE OF SYSTEM
C                                                         RELIABILITY
C            RNEW           ITRUNC          INT           SYSTEM RELIABILITY WITH WITH A
C                                                         REDUNDANCY ADDED
```

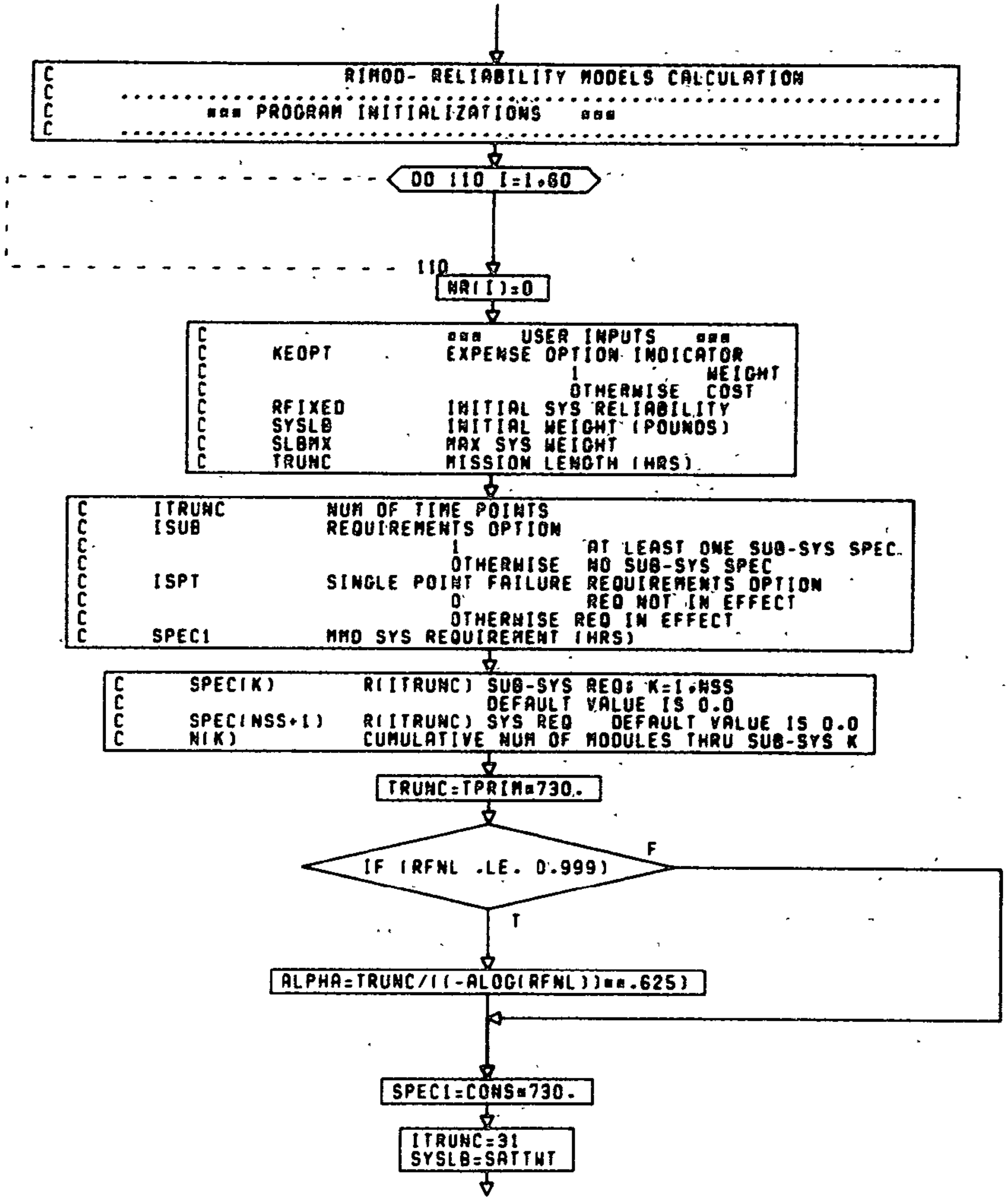
```
C             RI            ITRUNC        EXT- C          SYSTEM RELIABILITY MATRIX
C                           *N(NSS)
C            COST            N(NSS)       EXT-NC          VALUE OF EXPENSE OPTION FOR
C                                                         MODULE J
C             RHO              1            INT           DECISION PARAMETER(
C                                                           ABS(*NEW - *OLD)/EXPENSE
C            RHOTH             1          EXT-NC          LOWER BOUND FOR RHO
C            OLDRHO            1            INT           PREVIOUS VALUE OF RHO
```

```
C            MMDOLD            1            INT           PREVIOUS MMD VALUE
C            MMDNEW            1            INT           MMD VALUE WITH A REDUNDANCY
C                                                         ADDED
C            JSAVE             1            INT           MODULE WITH LARGEST VALUE OF
C                                                         RHO
C            SAVRNW         ITRUNC          INT           SYSTEM RELIABILITY FNC WITH A
C                                                         REDUNDANCY IN MODULE JSAVE
C            SAVR           ITRUNC          INT           RELIABILITY FNC FOR MODULE
```

```
C                                                         JSAVE WITH A REDUNDANCY ADDED
C            SAVMMD            1            INT           MMD WITH A REDUNDANCY ADDED IN
C                                                         MODULE JSAVE
C            SYSLB             1          EXT- C          SYSTEM WEIGHT
C            SLBMX             1          EXT-NC          MAX SYSTEM WEIGHT
C          DATAB(1,J)       N(NSS)        EXT-NC          REDUNDANCY WEIGHT FOR MODULE J
C             IND              1            INT           LOOP INDEX
C              I               1            INT           INDEX
```

```
C            RFIXED            1          EXT-NC          INITIAL RELIABILITY
C     SUBROUTINES CALLED
C                           QSF -  INTEGRATION BY SIMPSONTS RULE  (SSP)
```

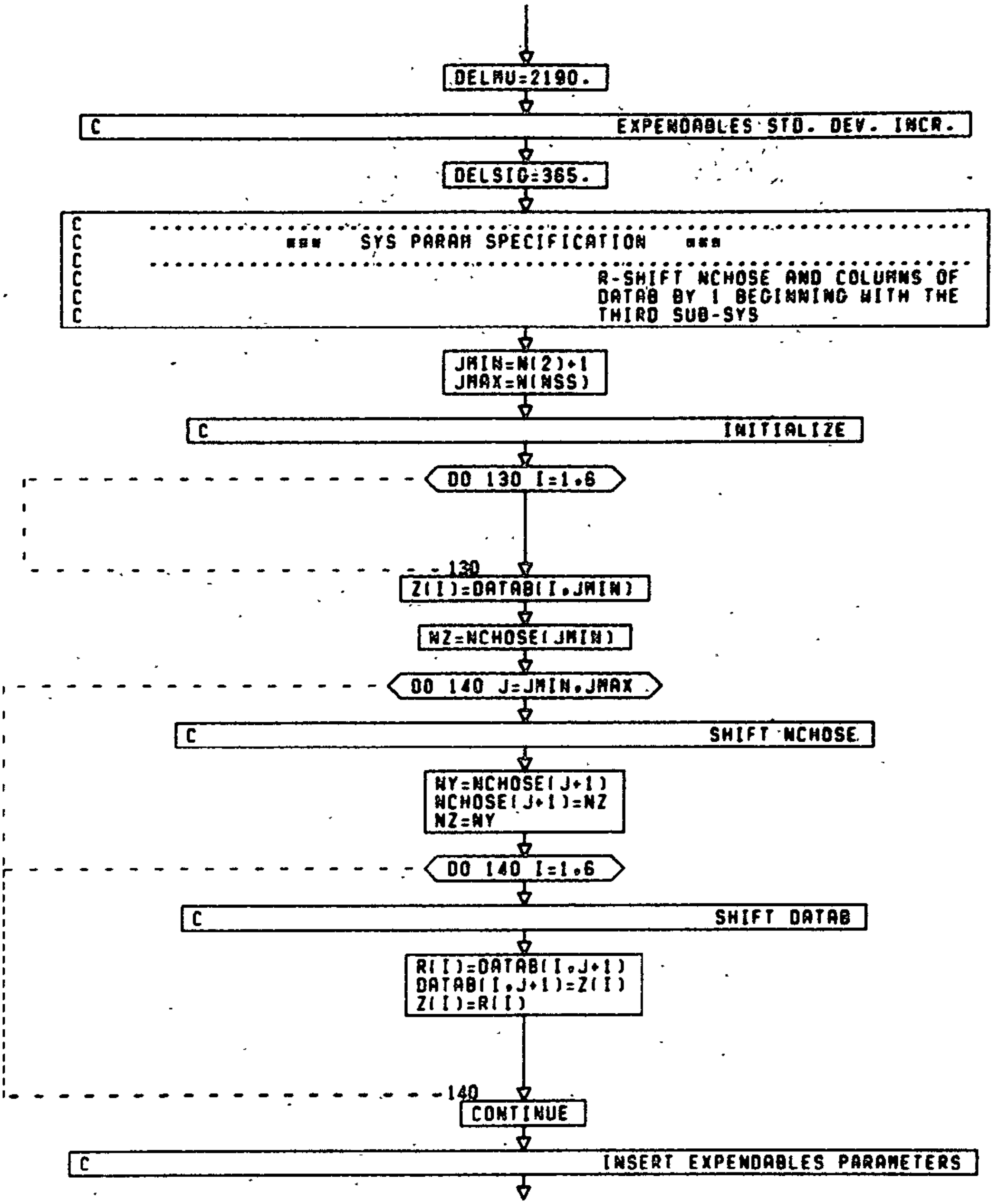
CONT. ON PG 3


C RIMOD- RELIABILITY MODELS CALCULATION
C ***PROGRAM INITIALIZATIONS ***
DO 110 I=1,60
110
NR(I)=0
C *** USER INPUTS ***
C KEOPT EXPENSE OPTION INDICATOR
C 1 WEIGHT
C OTHERWISE COST
C RFIXED INITIAL SYS RELIABILITY
C SYSLB INITIAL WEIGHT (POUNDS)
C SLBMX MAX SYS WEIGHT
C TRUNC MISSION LENGTH (HRS)
C ITRUNC NUM OF TIME POINTS
C ISUB REQUIREMENTS OPTION
C 1 AT LEAST ONE SUB-SYS SPEC
C OTHERWISE NO SUB-SYS SPEC
C ISPT SINGLE POINT FAILURE REQUIREMENTS OPTION
C 0 REQ NOT IN EFFECT
C OTHERWISE REQ IN EFFECT
C SPEC1 MMD SYS REQUIREMENT (HRS)
C SPEC(K) R(ITRUNC) SUB-SYS REQ; K=1,NSS
C DEFAULT VALUE IS 0.0
C SPEC(NSS+1) R(ITRUNC) SYS REQ DEFAULT VALUE IS 0.0
C N(K) CUMULATIVE NUM OF MODULES THRU SUB-SYS K
TRUNC=TPRIM*730.
IF (RFNL .LE. 0.999)
F
T
ALPHA=TRUNC/((-ALOG(RFNL))**.625)
SPEC1=CONS*730.
ITRUNC=31
SYSLB=SATTWT

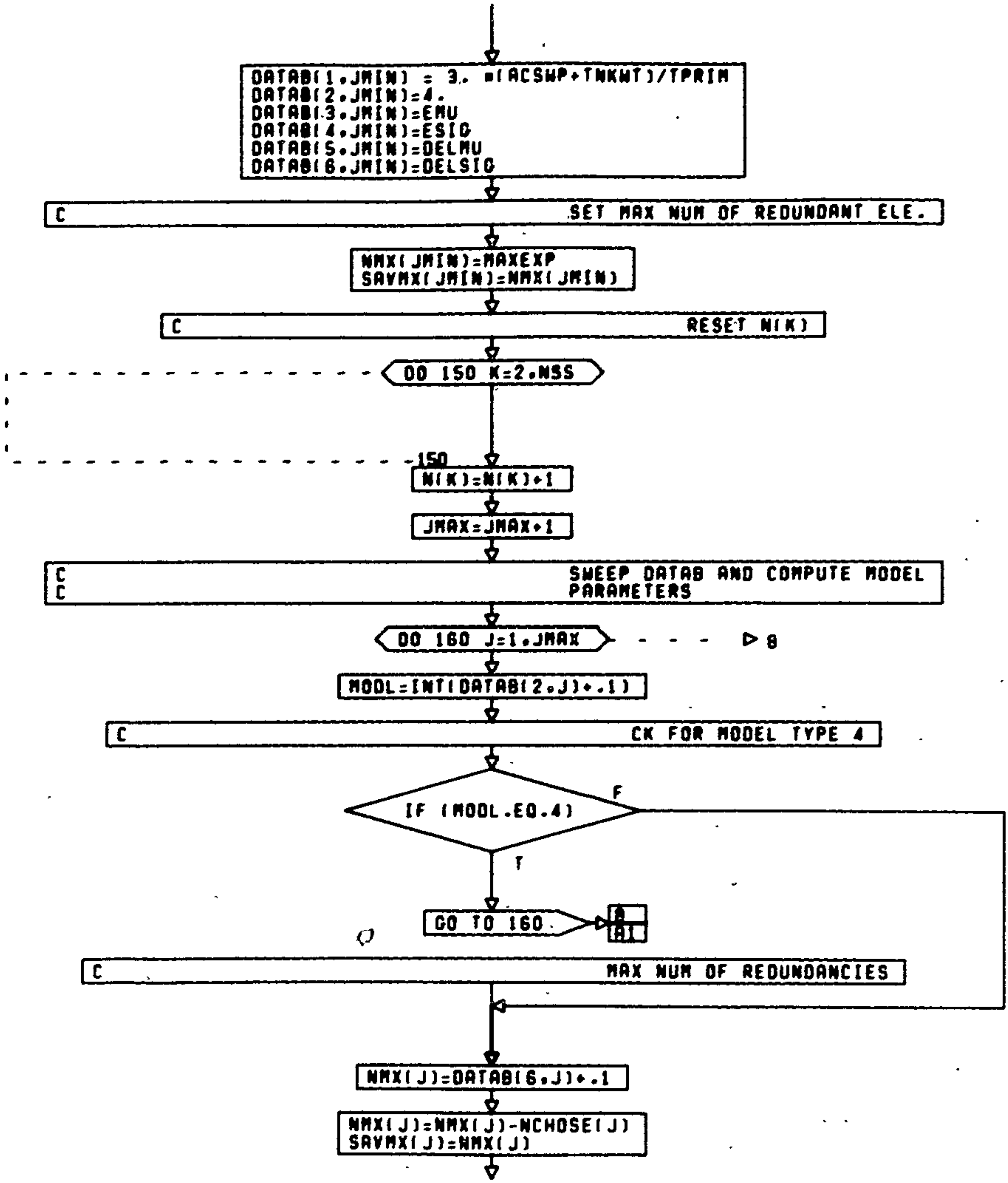
CONT. ON PG 4

```
C                                              SET NUM OF SUB SYS
NSS=5
C                                              ACCUMULATE N
N(1)=NEQUIP(1)
DO 100 I=2,NSS
100
N(I)=NEQUIP(I)+N(I-1)
C                       ***   SIS INPUTS    ***
C      ACSWP            INITIAL EXPENDABLES WEIGHT  (POUNDS)              AP
C      EMU              EXPENDABLES INITIAL MEAN LIFETIME  (HRS)          AP
C      ESIG             EXPENDABLES INITIAL STD. DEV.  (HRS)              AP
C      MAXEXP           MAX NUM OF EXPENDABLE INCREMENTS                  AP
C      NZERO            ORBITAL MEAN MOTION  (RAD/HRS)                    AP
C      DC               DUTY CYCLE                                        OTHER
C      TB               BATTERY TEMP  (DEGREES KELVIN)                    OTHER
C      D                DEPTH OF DISCHARGE  (BETWEEN 0 AND 100)           OTHER
C      NC               TOTAL NUM OF CELLS  (ALL BATTERIES)               OTHER
C      PARAMETERS NECESSARY TO COMPUTE THE CYCLES/HR FACTOR               S^C
C                       NOW FIXED AT 4.0E-11, REF MODEL 5
EMU=TRUNC
ESIG=TRUNC/6.
MAXEXP=20
DC=.1
TB=TBI+273.
C                       ***   FIXED CONSTANTS    ***
C                                         SENSE/SWITCH FAILURE RATE
LAMS=120.
C                                         PAYOFF THRESHOLD, R(TRUNC)
RHO1=0.00001
C                                         PAYOFF THRESHOLD, MMD
RHO2=0.1
C                                         EXPENDABLES LIFE INCR.
```

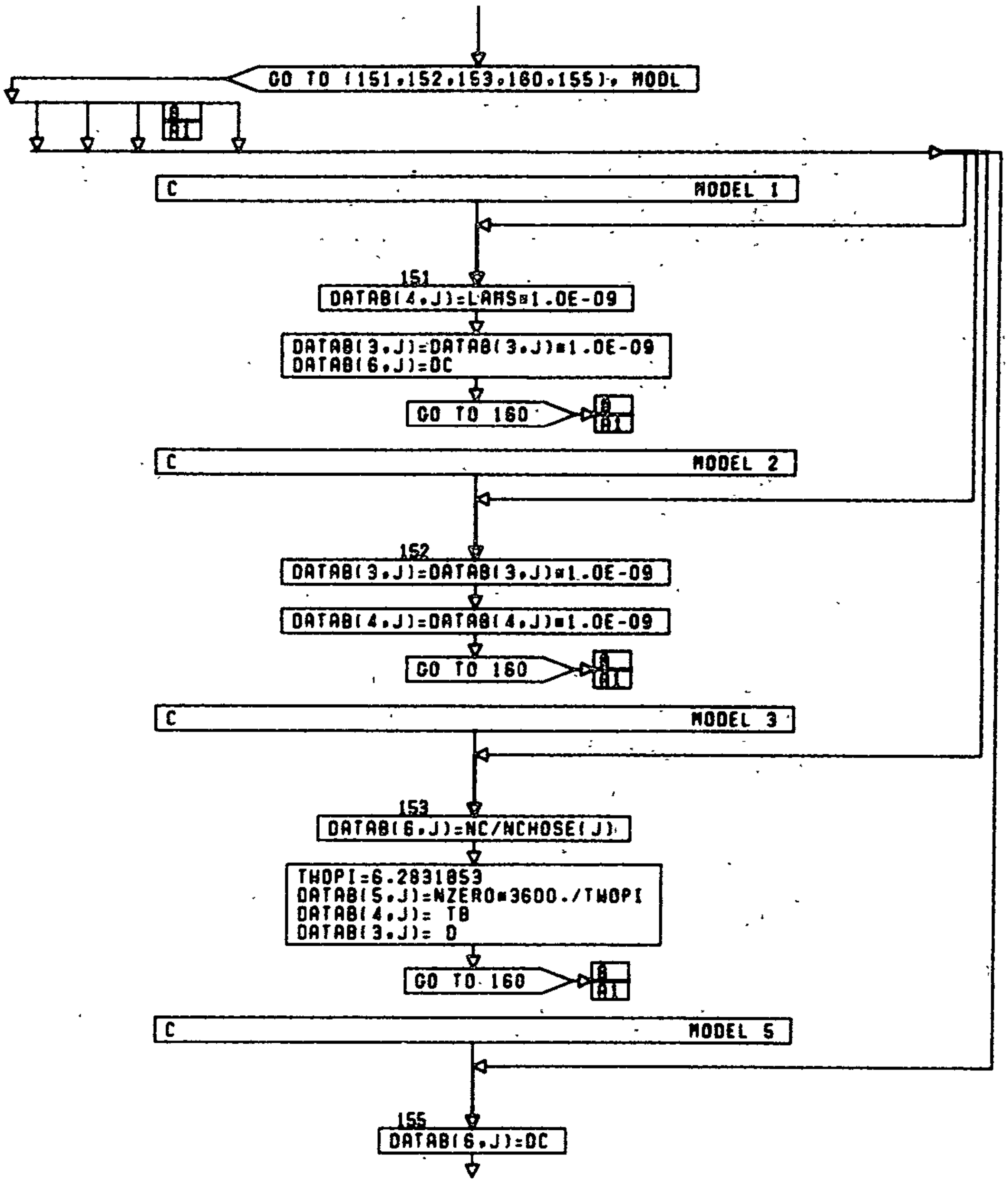
CONT. ON PG 5


DELMU=2190.
C EXPENDABLES STD. DEV. INCR.
DELSIG=365.
C ***
C *** SYS PARAM SPECIFICATION ***
C ***
C R-SHIFT NCHOSE AND COLUMNS OF
C DATAB BY 1 BEGINNING WITH THE
C THIRD SUB-SYS
JMIN=N(2)+1
JMAX=N(NSS)
C INITIALIZE
DO 130 I=1,6
130
Z(I)=DATAB(I,JMIN)
NZ=NCHOSE(JMIN)
DO 140 J=JMIN,JMAX
C SHIFT NCHOSE
NY=NCHOSE(J+1)
NCHOSE(J+1)=NZ
NZ=NY
DO 140 I=1,6
C SHIFT DATAB
R(I)=DATAB(I,J+1)
DATAB(I,J+1)=Z(I)
Z(I)=R(I)
140
CONTINUE
C INSERT EXPENDABLES PARAMETERS

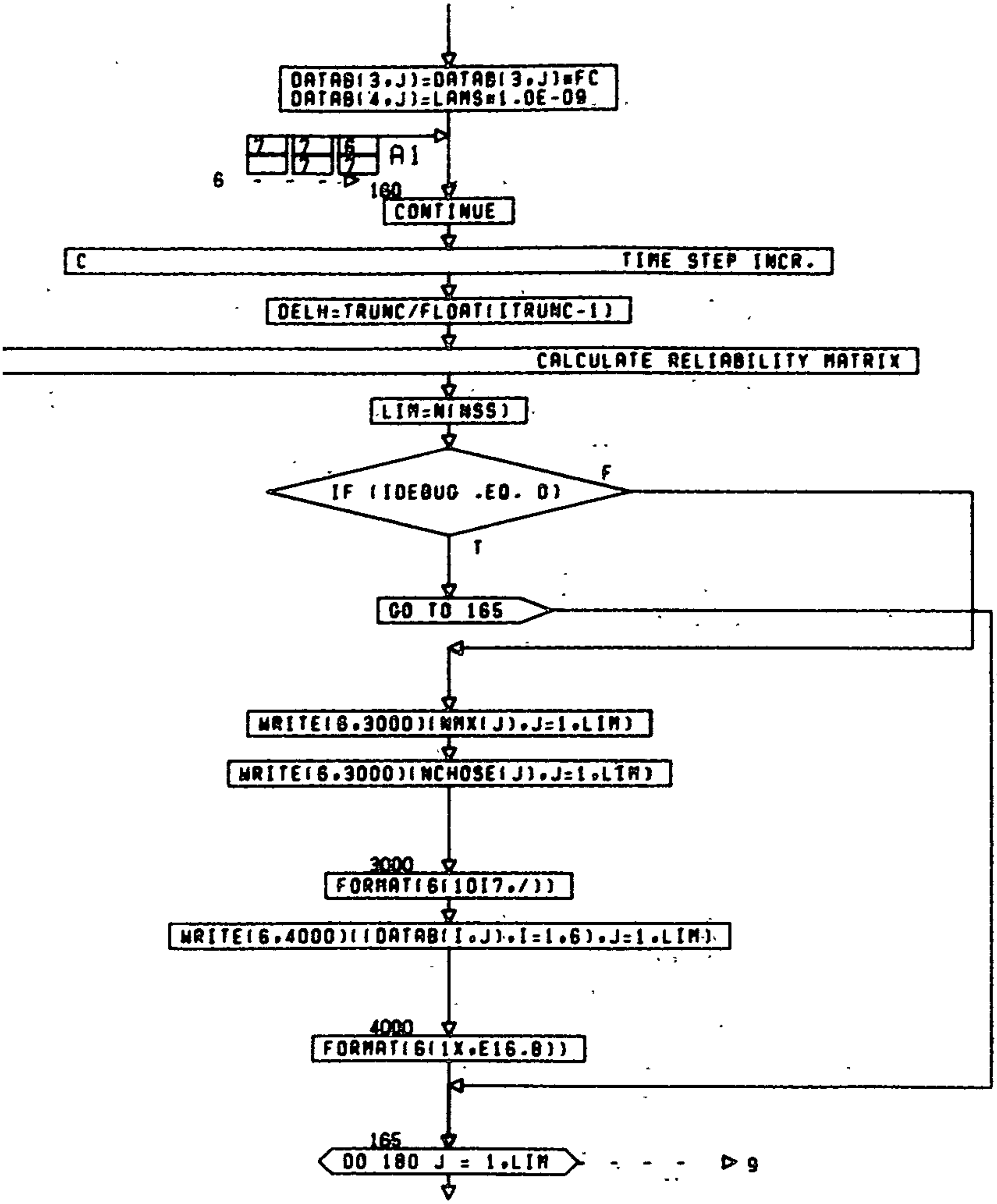
CONT. ON PG 6


DATAB(1,JMIN) = 3. *(ACSWP+TNKWT)/TPRIM
DATAB(2,JMIN)=4.
DATAB(3,JMIN)=EMU
DATAB(4,JMIN)=ESIG
DATAB(5,JMIN)=DELMU
DATAB(6,JMIN)=DELSIG
C SET MAX NUM OF REDUNDANT ELE.
NMX(JMIN)=MAXEXP
SAVMX(JMIN)=NMX(JMIN)
C RESET N(K)
DO 150 K=2,NSS
150
N(K)=N(K)+1
JMAX=JMAX+1
C SWEEP DATAB AND COMPUTE MODEL
C PARAMETERS
DO 160 J=1,JMAX
8
MODL=INT(DATAB(2,J)+.1)
C CK FOR MODEL TYPE 4
IF (MODL.EQ.4)
F
T
GO TO 160
A
A1
C MAX NUM OF REDUNDANCIES
NMX(J)=DATAB(6,J)+.1
NMX(J)=NMX(J)-NCHOSE(J)
SAVMX(J)=NMX(J)

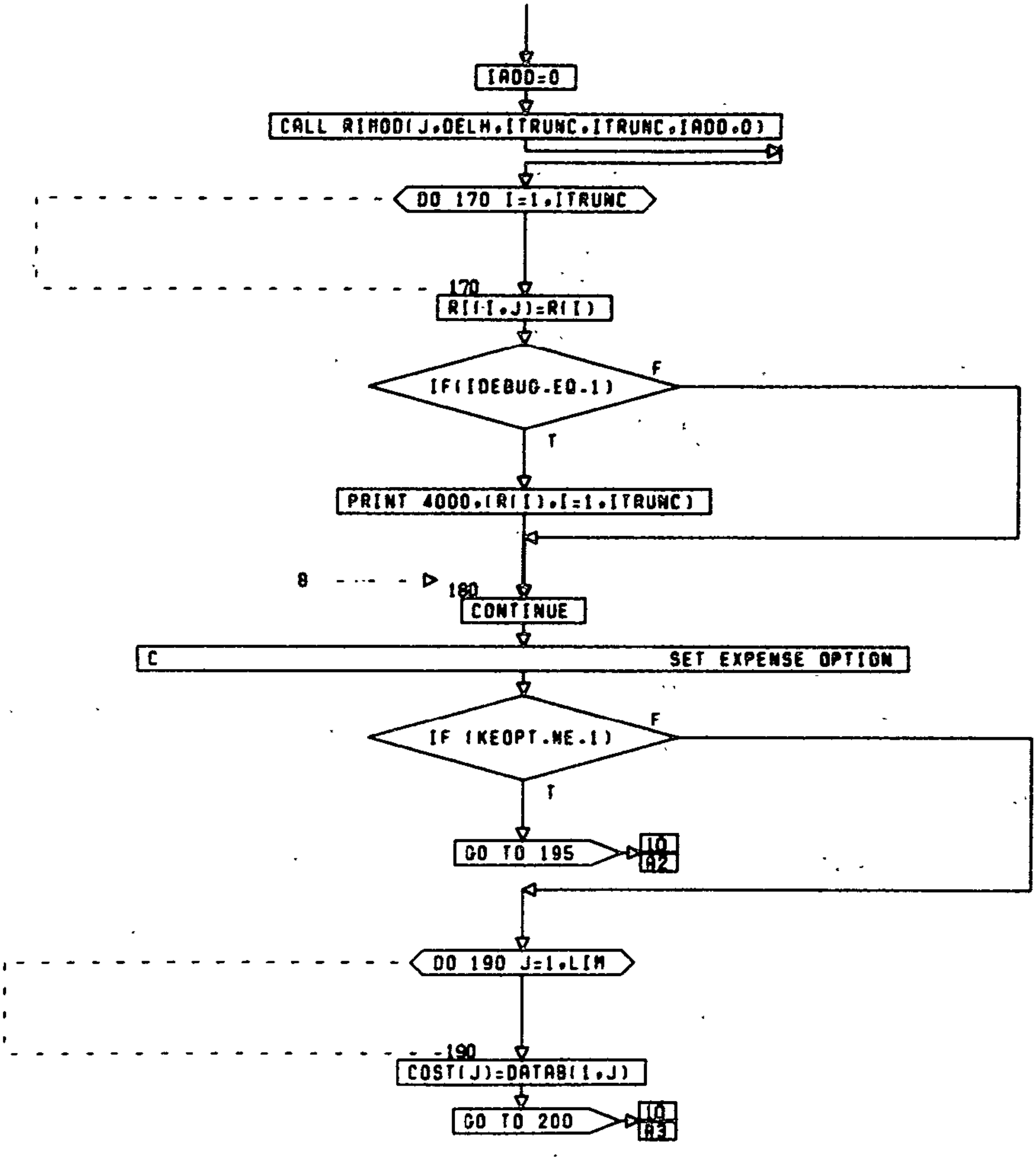
CONT. ON PG 7


GO TO (151,152,153,160,155), MODL
A
A1
C MODEL 1
151
DATAB(4,J)=LAMS*1.0E-09
DATAB(3,J)=DATAB(3,J)*1.0E-09
DATAB(6,J)=DC
GO TO 160
A
A1
C MODEL 2
152
DATAB(3,J)=DATAB(3,J)*1.0E-09
DATAB(4,J)=DATAB(4,J)*1.0E-09
GO TO 160
A
A1
C MODEL 3
153
DATAB(6,J)=NC/NCHOSE(J)
TWOPI=6.2831853
DATAB(5,J)=NZERO*3600./TWOPI
DATAB(4,J)= TB
DATAB(3,J)= D
GO TO 160
A
A1
C MODEL 5
155
DATAB(6,J)=DC

CONT. ON PG 8

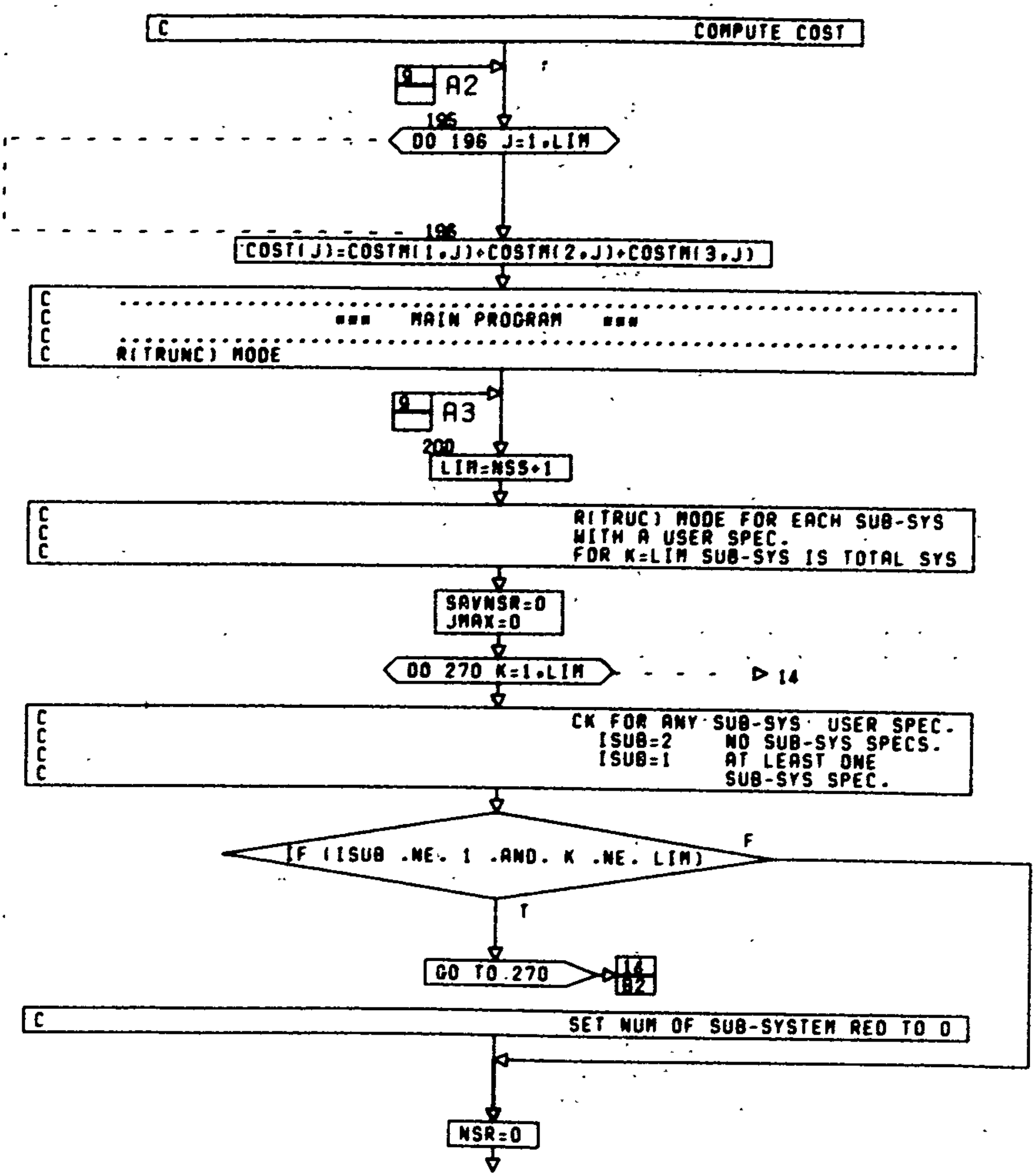

DATAB(3,J)=DATAB(3,J)*FC
DATAB(4,J)=LAMS*1.0E-09
A1
6
160
CONTINUE
C
TIME STEP INCR.
DELH=TRUNC/FLOAT(ITRUNC-1)
CALCULATE RELIABILITY MATRIX
LIM=N(NSS)
IF (IDEBUG .EQ. 0)
F
T
GO TO 165
WRITE(6,3000)(NMX(J),J=1,LIM)
WRITE(6,3000)(NCHOSE(J),J=1,LIM)
3000
FORMAT(6(10I7,/))
WRITE(6,4000)((DATAB(I,J),I=1,6),J=1,LIM)
4000
FORMAT(6(1X,E16.8))
165
DO 180 J = 1,LIM
9

CONT. ON PG 9



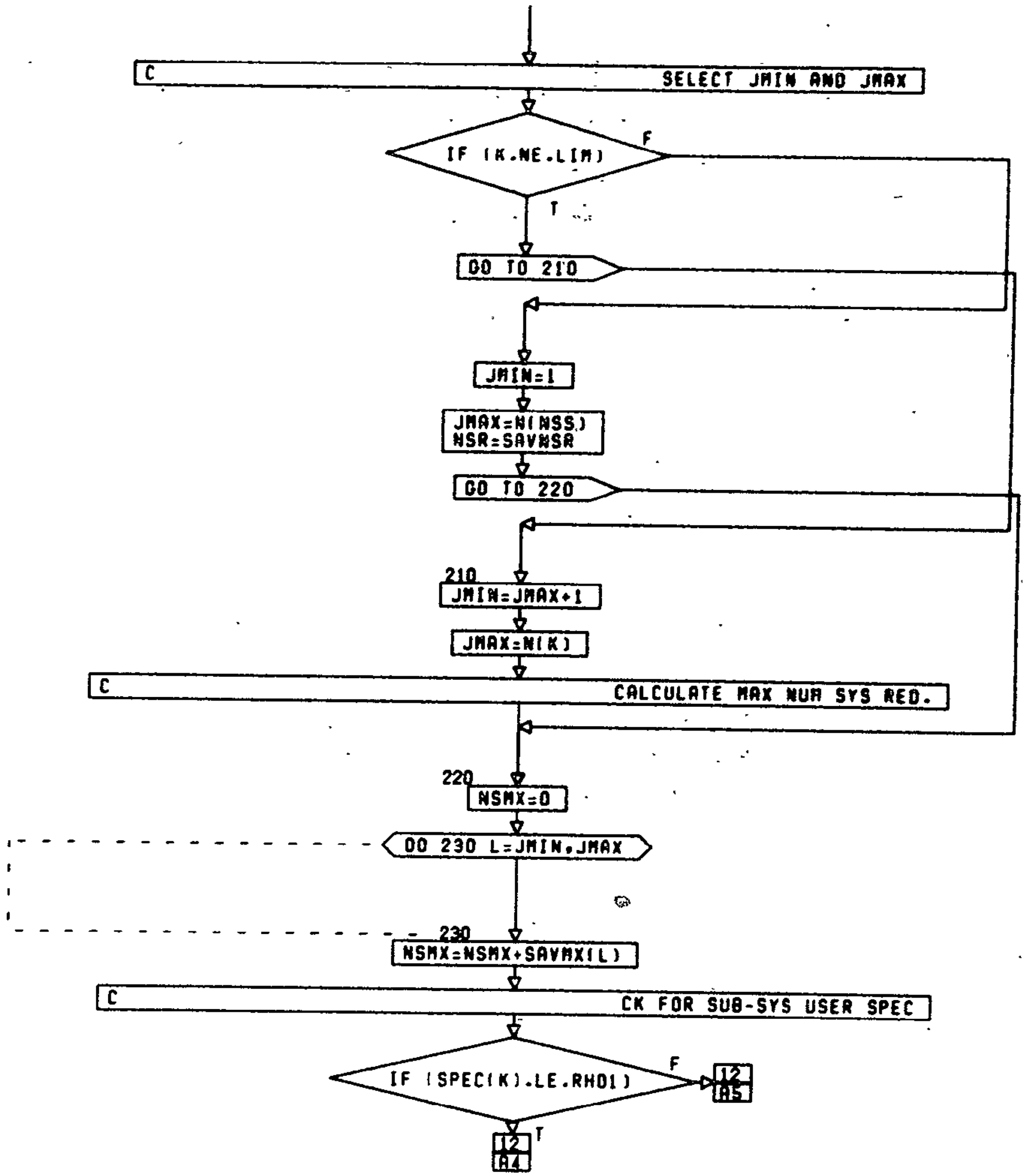
IADD=0
CALL RIMOD(J,DELH,ITRUNC,ITRUNC,IADD,0)
DO 170 I=1,ITRUNC
170
R(I-I,J)=R(I)
IF(IDEBUG.EQ.1)
F
T
PRINT 4000,(R(I),I=1,ITRUNC)
8
180
CONTINUE
C
SET EXPENSE OPTION
IF (KEOPT.NE.1)
F
T
GO TO 195
10
A2
DO 190 J=1,LIM
190
COST(J)=DATAB(1,J)
GO TO 200
10
A3

CONT. ON PG 10

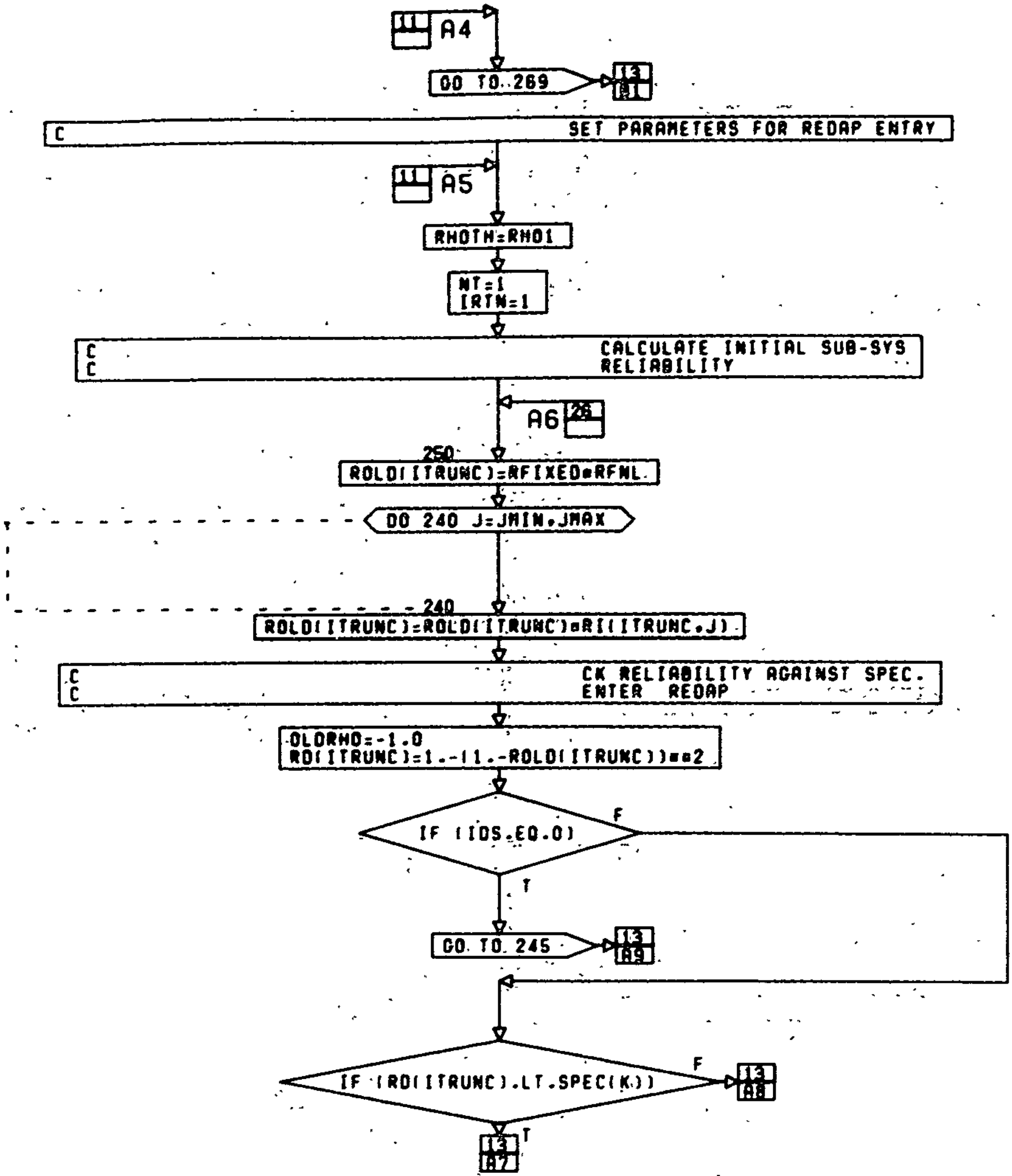


CONT. ON PG 11

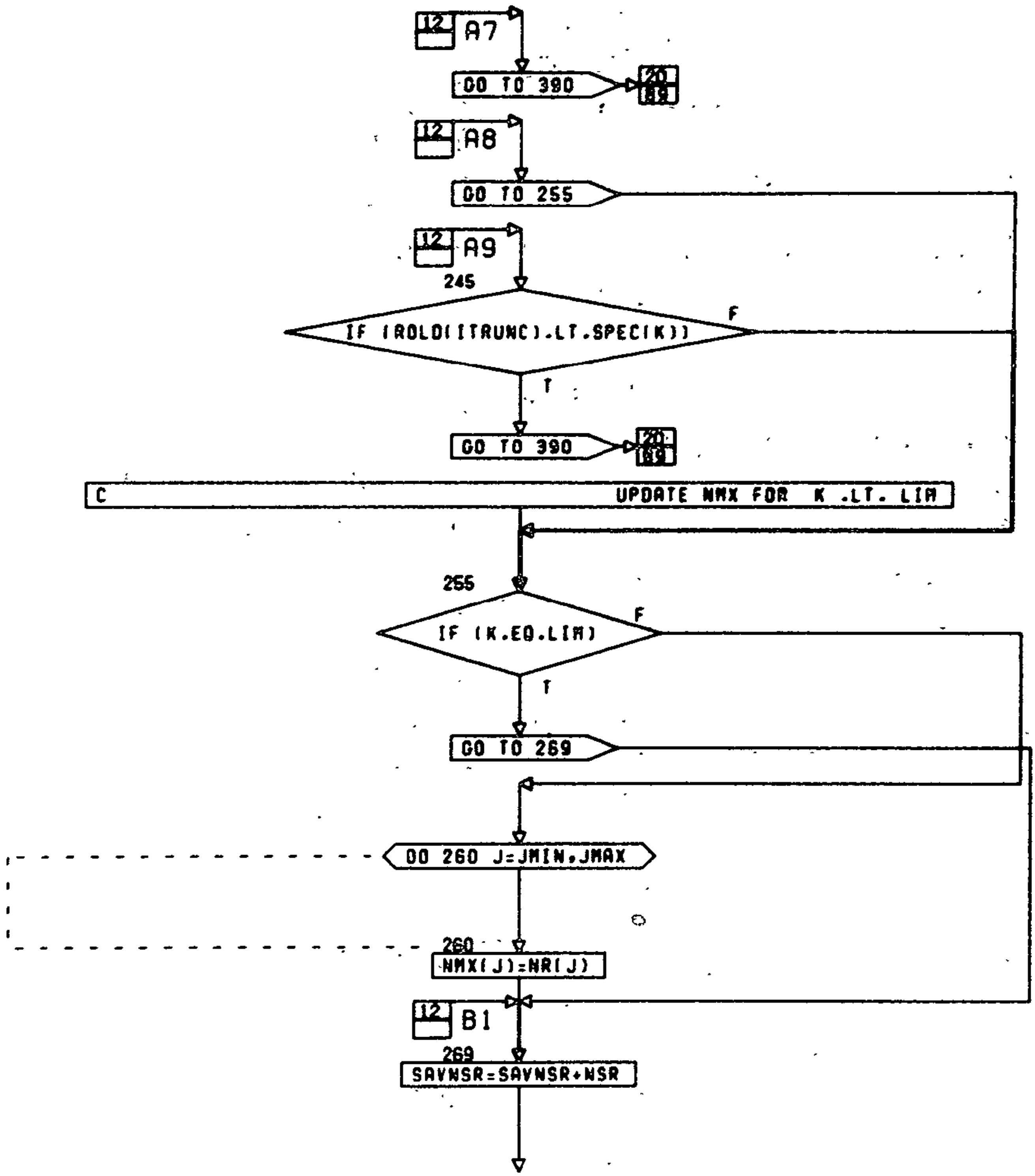
PG 10F 27


C
SELECT JMIN AND JMAX
IF (K.NE.LIM)
F
T
GO TO 210
JMIN=1
JMAX=N(NSS)
NSR=SAVNSR
GO TO 220
210
JMIN=JMAX+1
JMAX=N(K)
C
CALCULATE MAX NUM SYS REQ.
220
NSMX=0
DO 230 L=JMIN,JMAX
230
NSMX=NSMX+SAVMX(L)
C
CK FOR SUB-SYS USER SPEC
IF (SPEC(K).LE.RHO1)
F
12
A5
T
12
A4

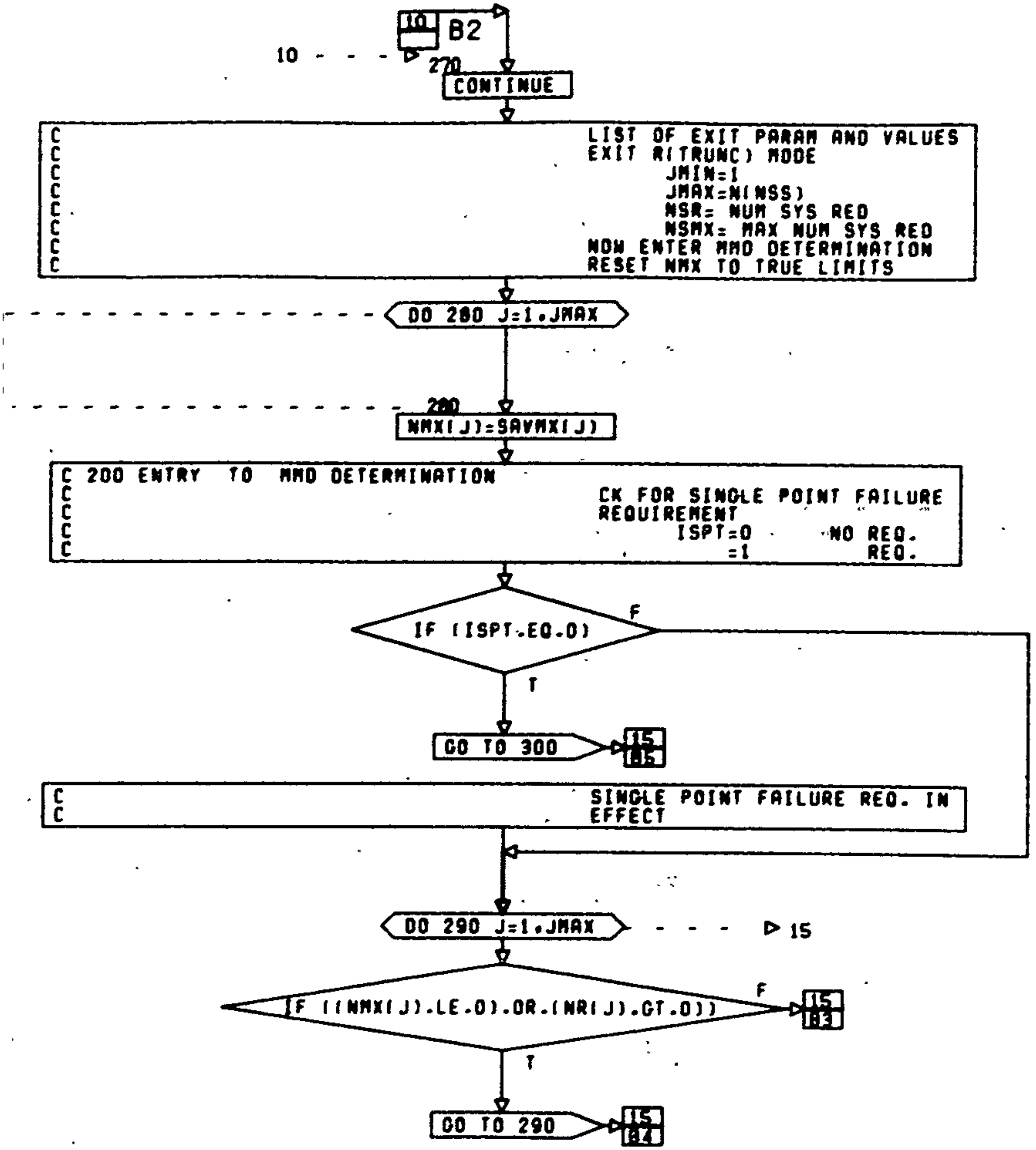
CONT. ON PG 12


11
A4
GO TO 269
13
A1
C SET PARAMETERS FOR REDAP ENTRY
11
A5
RHOTH=RHO1
NT=1
IRTN=1
C CALCULATE INITIAL SUB-SYS
C RELIABILITY
A6
26
250
ROLD(ITRUNC)=RFIXED*RFNL
DO 240 J=JMIN,JMAX
240
ROLD(ITRUNC)=ROLD(ITRUNC)*RI(ITRUNC,J)
C CK RELIABILITY AGAINST SPEC.
C ENTER REDAP
OLDRHO=-1.0
RO(ITRUNC)=1.-(1.-ROLD(ITRUNC))**2
IF (IDS.EQ.0)
F
T
GO TO 245
13
A9
IF (RO(ITRUNC).LT.SPEC(K))
F
13
A8
T
13
A7

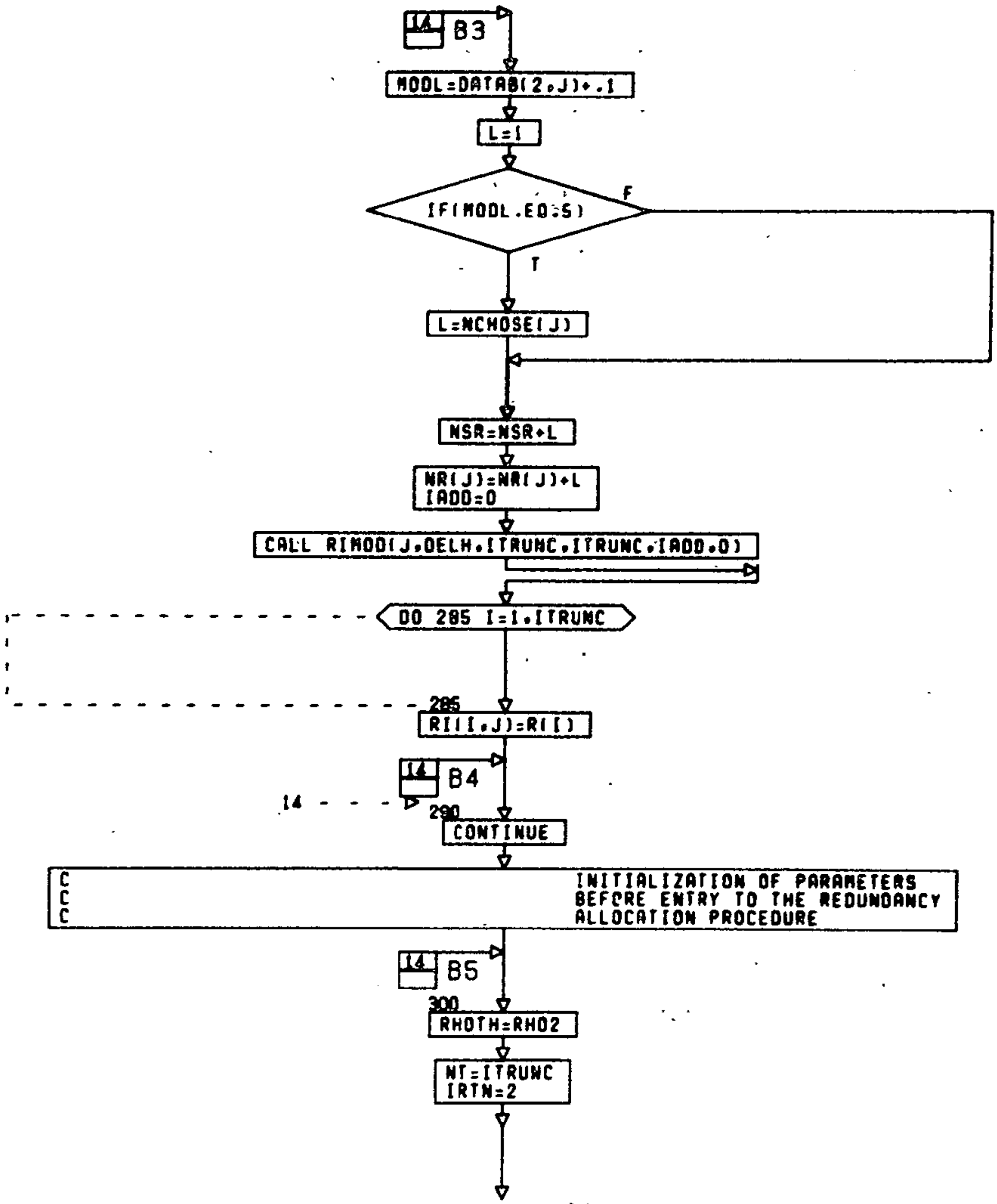
CONT. ON PG 13


12 A7
GO TO 390
20 B9
12 A8
GO TO 255
12 A9
245
IF (ROLD(ITRUNC).LT.SPEC(K))
F
T
GO TO 390
20 B9
C UPDATE NMX FOR K .LT. LIM
255
IF (K.EQ.LIM)
F
T
GO TO 269
DO 260 J=JMIN,JMAX
260
NMX(J)=NR(J)
12 B1
269
SAVNSR=SAVNSR+NSR

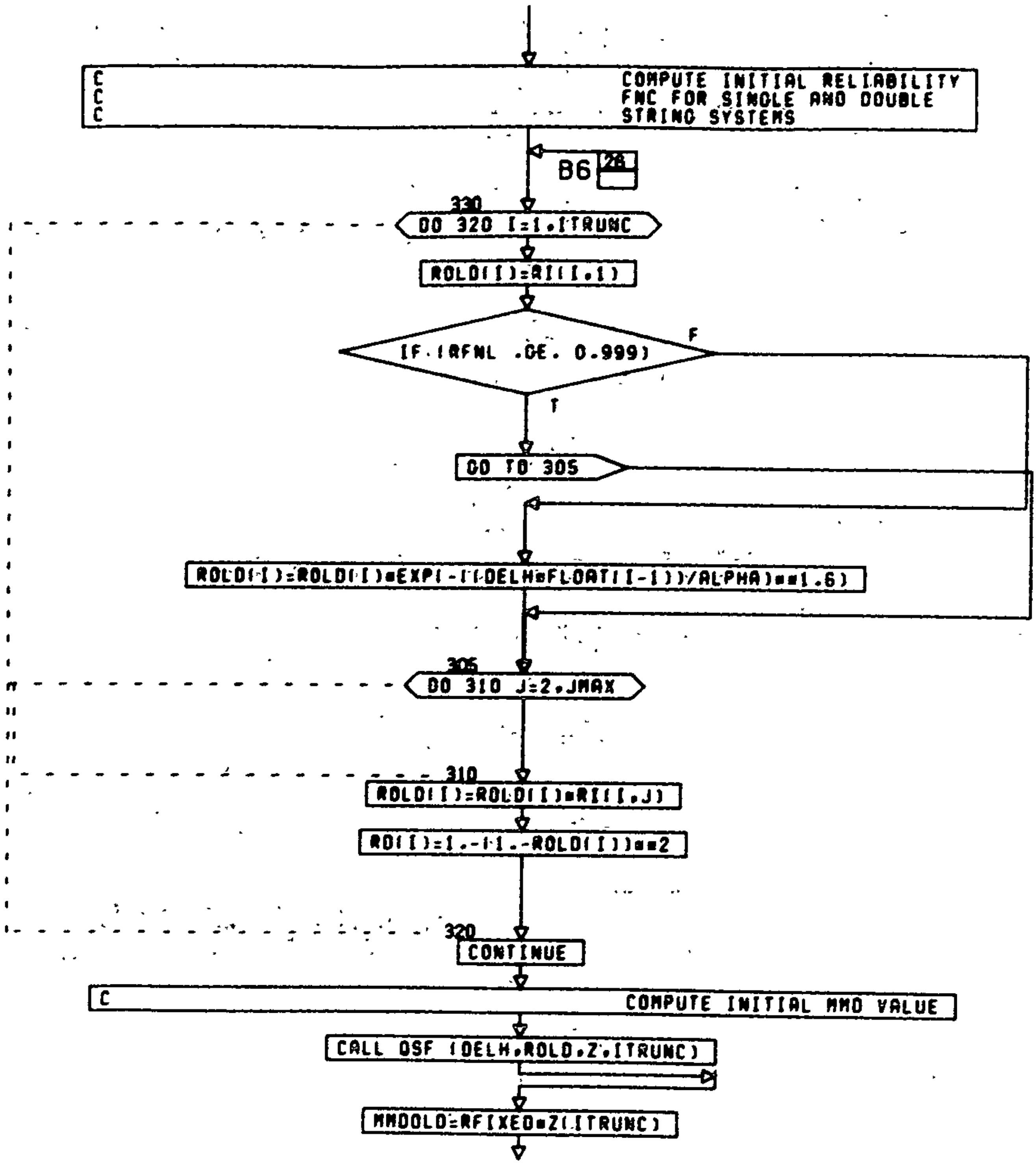
CONT. ON PG 14


10
B2
10
270
CONTINUE
C LIST OF EXIT PARAM AND VALUES
C EXIT R(TRUNC) MODE
C JMIN=1
C JMAX=N(NSS)
C NSR= NUM SYS REQ
C NSMX= MAX NUM SYS REQ
C NOW ENTER MMD DETERMINATION
C RESET NMX TO TRUE LIMITS
DO 280 J=1,JMAX
280
NMX(J)=SAVMX(J)
C 200 ENTRY TO MMD DETERMINATION
C CK FOR SINGLE POINT FAILURE
C REQUIREMENT
C ISPT=0 NO REQ.
C =1 REQ.
IF (ISPT.EQ.0)
F
T
GO TO 300
15
B5
C SINGLE POINT FAILURE REQ. IN
C EFFECT
DO 290 J=1,JMAX
15
IF ((NMX(J).LE.0).OR.(NR(J).GT.0))
F
15
B3
T
GO TO 290
15
B4

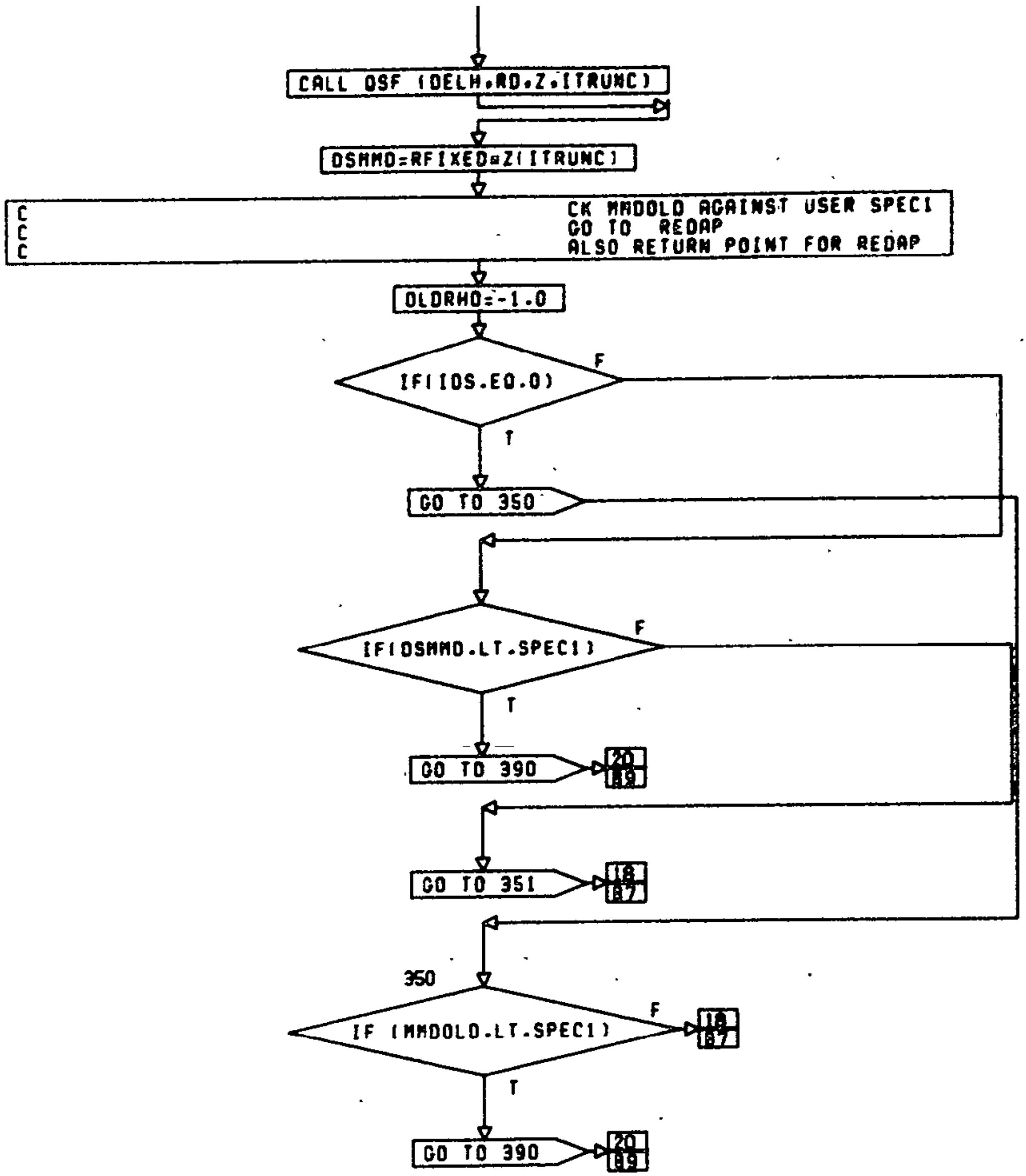
CONT. ON PG 15


14 B3
MODL=DATAB(2,J)+.1
L=1
IF(MODL.EQ.5)
F
T
L=NCHOSE(J)
NSR=NSR+L
NR(J)=NR(J)+L
IADD=0
CALL RIMOD(J,DELH,ITRUNC,ITRUNC,IADD,0)
DO 285 I=1,ITRUNC
285
RI(I,J)=R(I)
14 B4
14
290
CONTINUE
C INITIALIZATION OF PARAMETERS
C BEFORE ENTRY TO THE REDUNDANCY
C ALLOCATION PROCEDURE
14 B5
300
RHOTH=RHO2
NT=ITRUNC
IRTN=2

CONT. ON PG 16

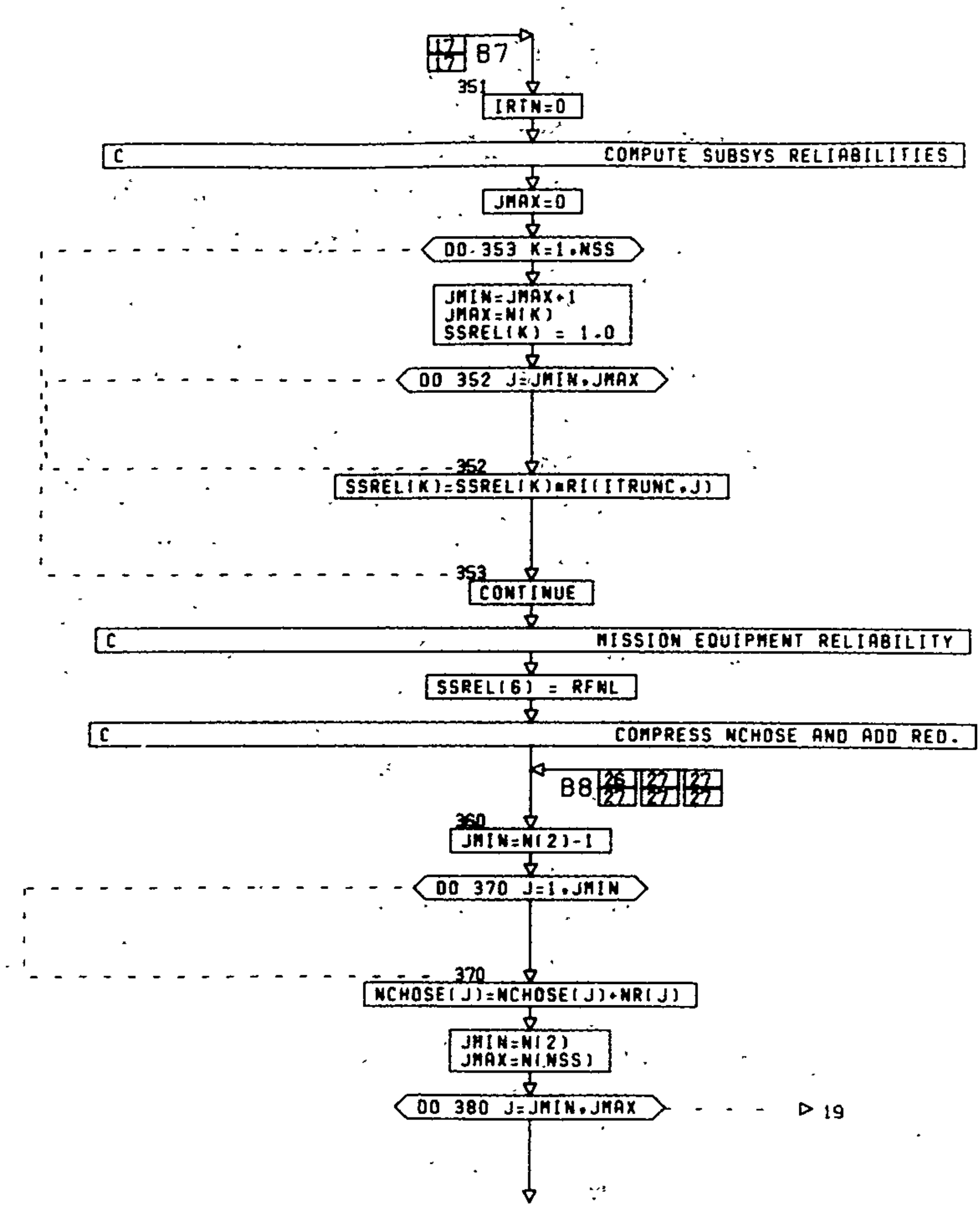

C COMPUTE INITIAL RELIABILITY
C FNC FOR SINGLE AND DOUBLE
C STRING SYSTEMS
B6
28
330
DO 320 I=1,ITRUNC
ROLD(I)=RI(I,1)
IF (RFNL .GE. 0.999)
F
T
GO TO 305
ROLD(I)=ROLD(I)*EXP(-((DELH*FLOAT(I-1))/ALPHA)**1.6)
305
DO 310 J=2,JMAX
310
ROLD(I)=ROLD(I)*RI(I,J)
RD(I)=1.-(1.-ROLD(I))**2
320
CONTINUE
C COMPUTE INITIAL MMD VALUE
CALL DSF (DELH,ROLD,Z,ITRUNC)
MMDOLD=RFIXED*Z(ITRUNC)

CONT. ON PG 17

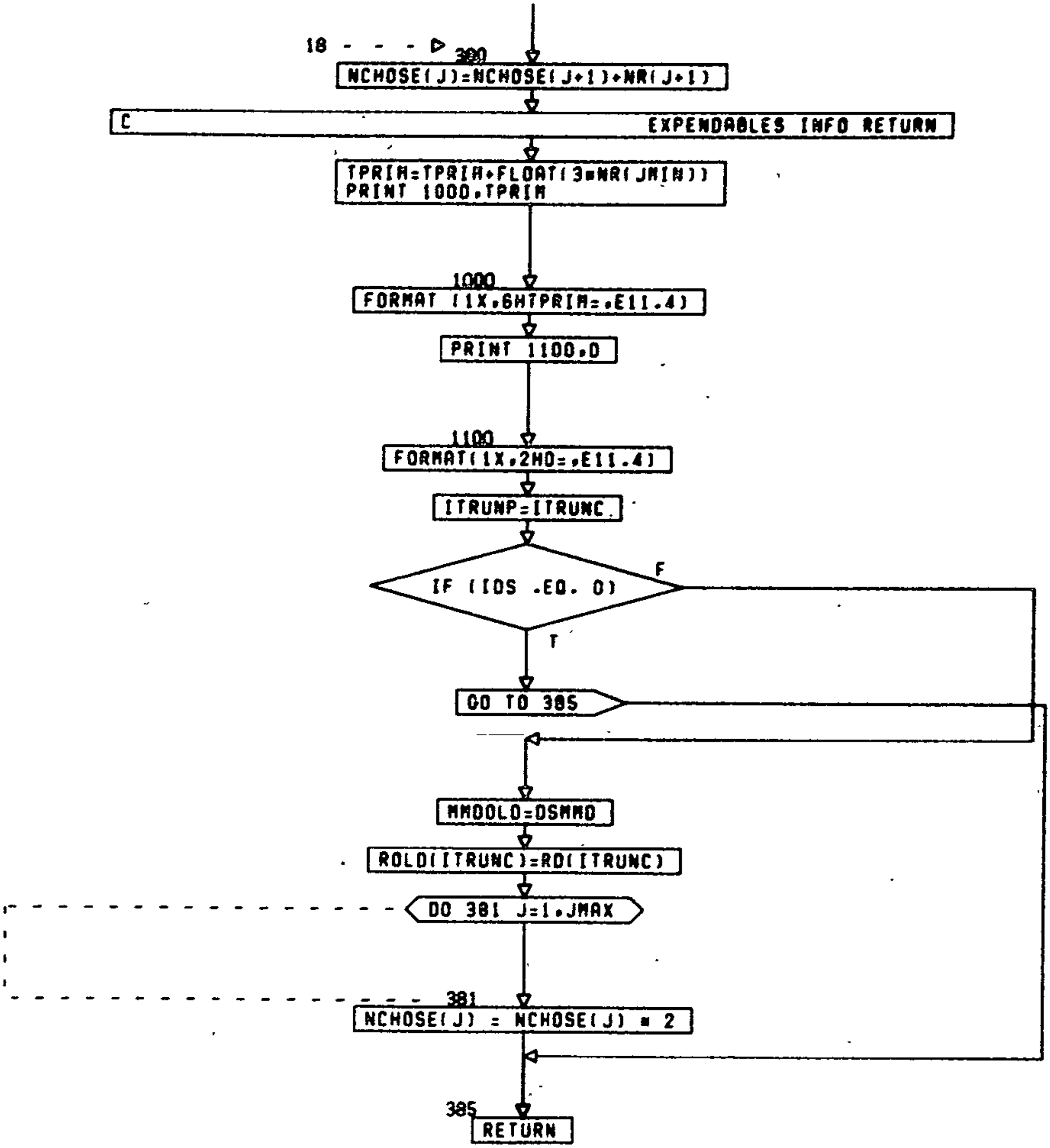


CALL DSF (DELH,RD,Z,ITRUNC)
DSMMD=RFIXED*Z(ITRUNC)
C CK MMDOLD AGAINST USER SPEC1
C GO TO REDAP
C ALSO RETURN POINT FOR REDAP
OLDRMO=-1.0
IF(IDS.EQ.0)
F
T
GO TO 350
IF(DSMMD.LT.SPEC1)
F
T
GO TO 390
20
89
GO TO 351
18
87
350
IF (MMDOLD.LT.SPEC1)
F
18
87
T
GO TO 390
20
89

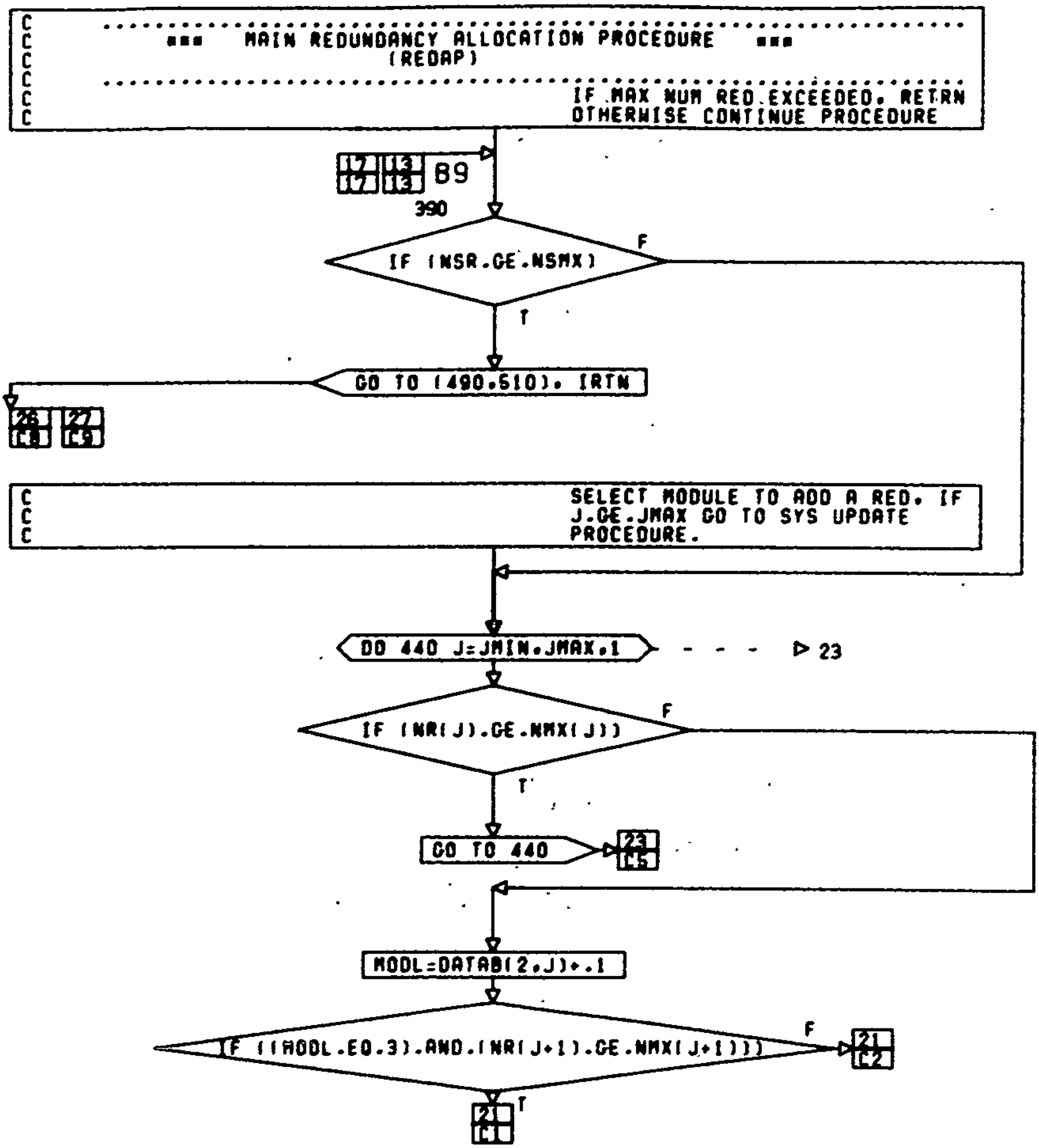
CONT. ON PG 18


17
17
B7
351
IRTN=0
C COMPUTE SUBSYS RELIABILITIES
JMAX=0
DO 353 K=1,NSS
JMIN=JMAX+1
JMAX=N(K)
SSREL(K) = 1.0
DO 352 J=JMIN,JMAX
352
SSREL(K)=SSREL(K)*RI(ITRUNC,J)
353
CONTINUE
C MISSION EQUIPMENT RELIABILITY
SSREL(6) = RFNL
C COMPRESS NCHOSE AND ADD RED.
B8
26
27
27
27
27
27
360
JMIN=N(2)-1
DO 370 J=1,JMIN
370
NCHOSE(J)=NCHOSE(J)+NR(J)
JMIN=N(2)
JMAX=N(NSS)
DO 380 J=JMIN,JMAX
19

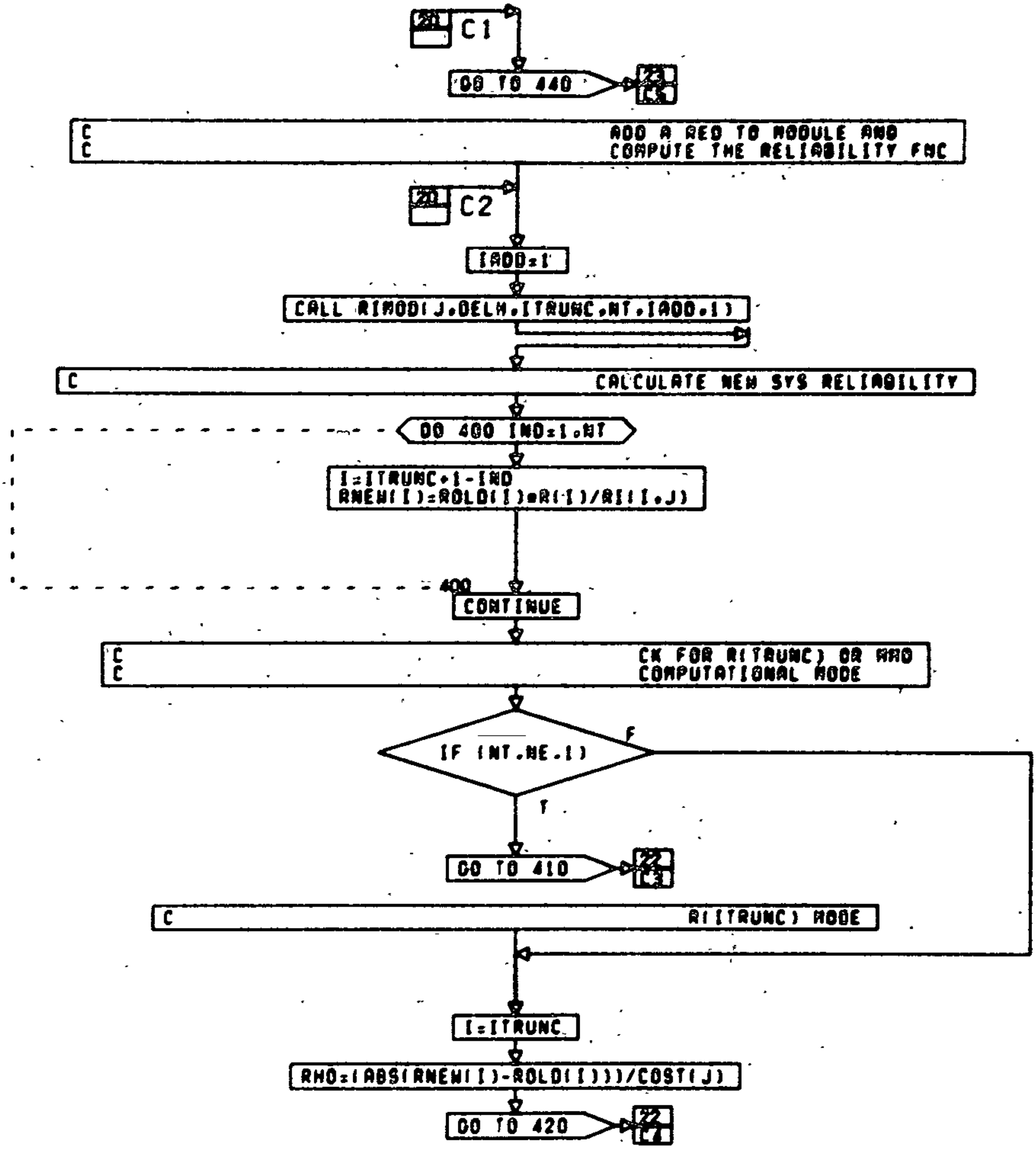
CONT. ON PG 19


18
300
NCHOSE(J)=NCHOSE(J+1)+NR(J+1)
C EXPENDABLES INFO RETURN
TPRIM=TPRIM+FLOAT(3*NR(JMIN))
PRINT 1000,TPRIM
1000
FORMAT (1X,6HTPRIM=,E11.4)
PRINT 1100,D
1100
FORMAT(1X,2HD=,E11.4)
ITRUNP=ITRUNC
IF (IDS .EQ. 0)
F
T
GO TO 385
MMDOLD=DSMMD
ROLD(ITRUNC)=RD(ITRUNC)
DO 381 J=1,JMAX
381
NCHOSE(J) = NCHOSE(J) * 2
385
RETURN

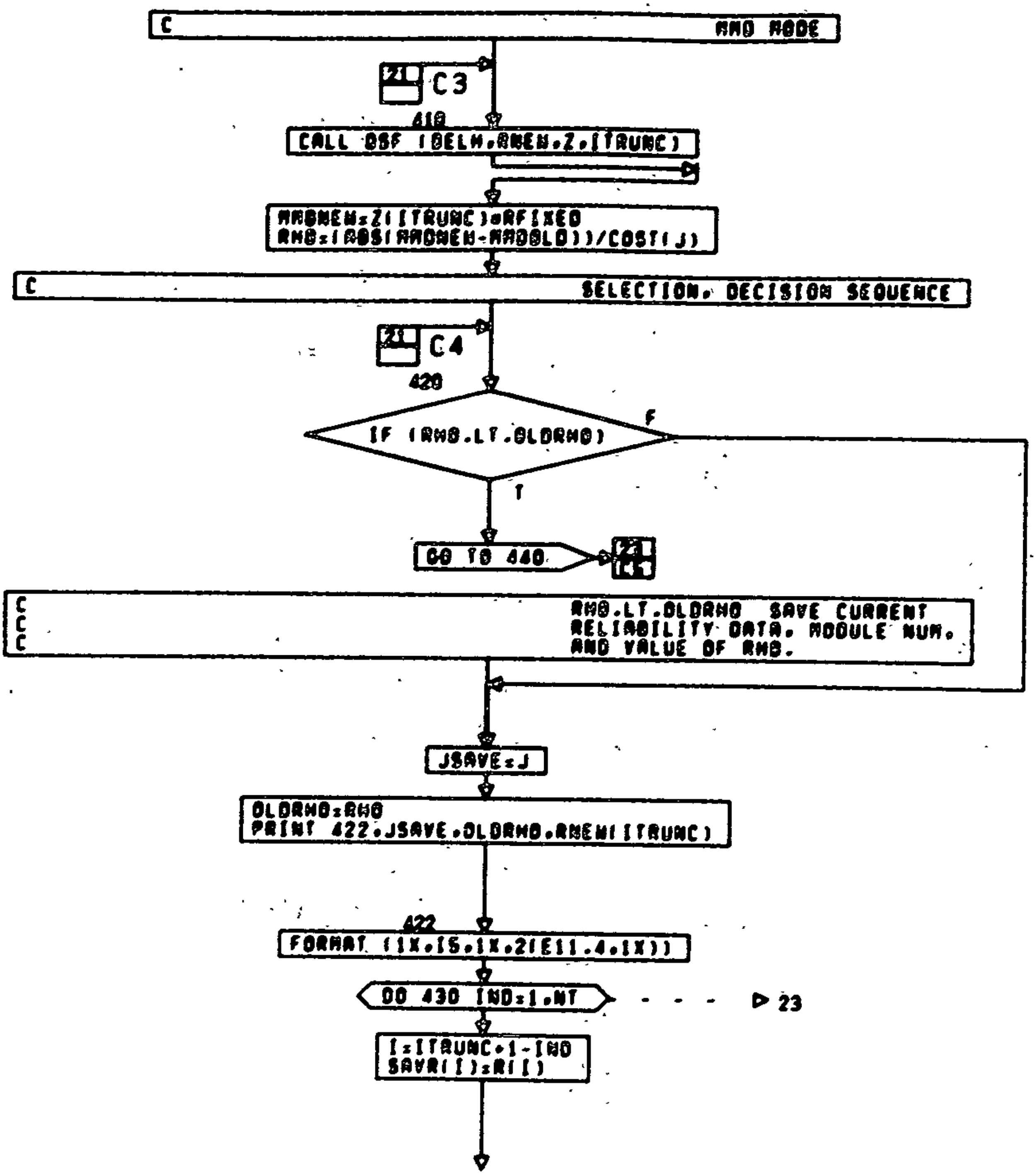
CONT. ON PG 20


C
C *** MAIN REDUNDANCY ALLOCATION PROCEDURE ***
C (REDAP)
C
C IF MAX NUM RED EXCEEDED, RETRN
C OTHERWISE CONTINUE PROCEDURE
17 13
17 13
89
390
IF (NSR.GE.NSMX)
F
T
GO TO (490,510), IRTN
26 27
C1 C5
C SELECT MODULE TO ADD A RED. IF
C J.GE.JMAX GO TO SYS UPDATE
C PROCEDURE.
DO 440 J=JMIN,JMAX,1
23
IF (NR(J).GE.NMX(J))
F
T
GO TO 440
23
C5
MODL=DATAB(2,J)+.1
IF ((MODL.EQ.3).AND.(NR(J+1).GE.NMX(J+1)))
F
21
C2
T
21
C1

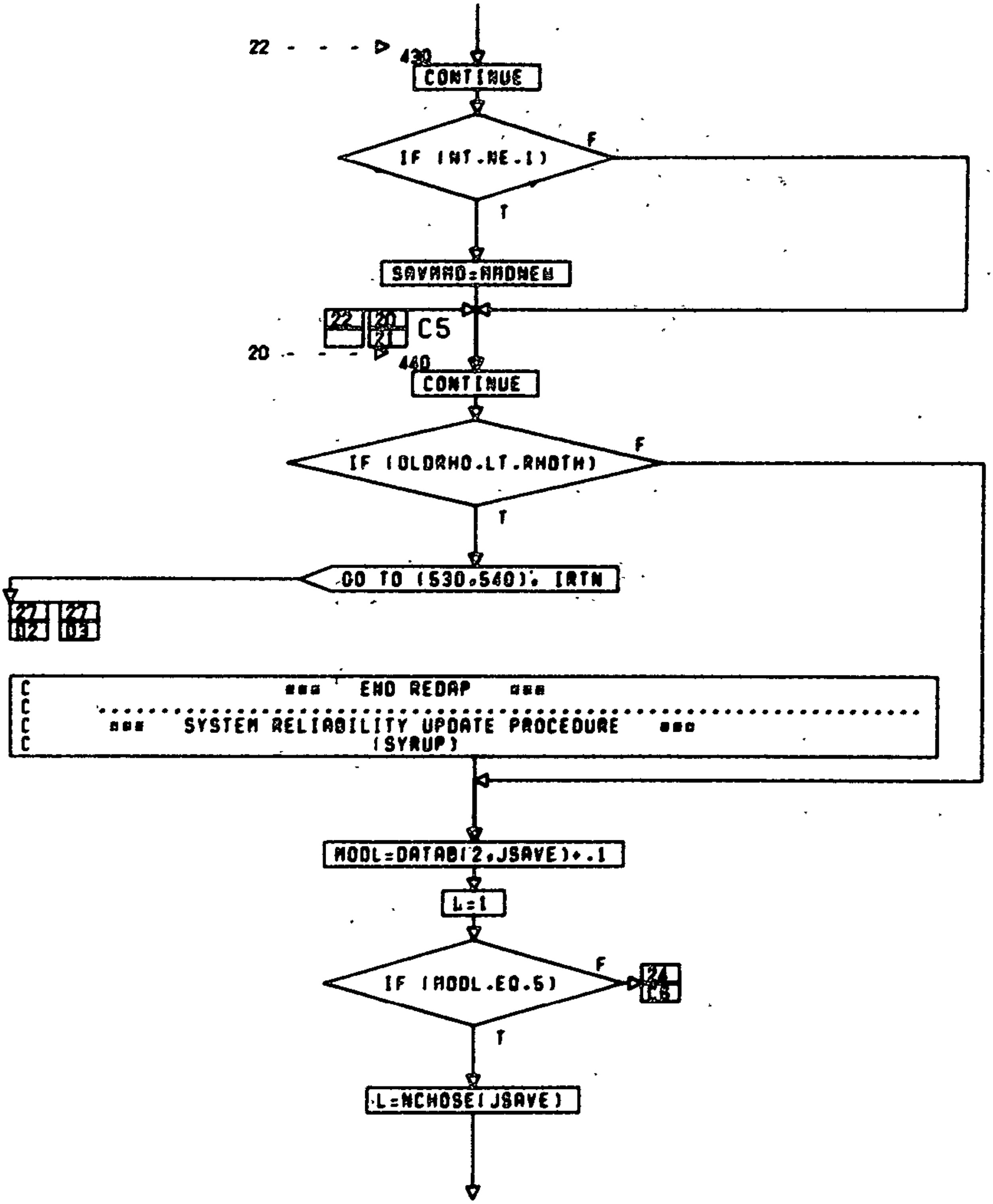
CONT. ON PG 21


20
C1
GO TO 440
23
C5
C ADD A RED TO MODULE AND
C COMPUTE THE RELIABILITY FNC
20
C2
IADD=1
CALL RIMOD(J,DELM,ITRUNC,NT,IADD,1)
C CALCULATE NEW SYS RELIABILITY
DO 400 IND=1,NT
I=ITRUNC+1-IND
RNEW(I)=ROLD(I)*R(I)/RI(I,J)
400
CONTINUE
C CK FOR R(TRUNC) OR RHO
C COMPUTATIONAL MODE
IF (NT.NE.1)
F
T
GO TO 410
22
C3
C R(ITRUNC) MODE
I=ITRUNC
RHO=(ABS(RNEW(I)-ROLD(I)))/COST(J)
GO TO 420
22
C4

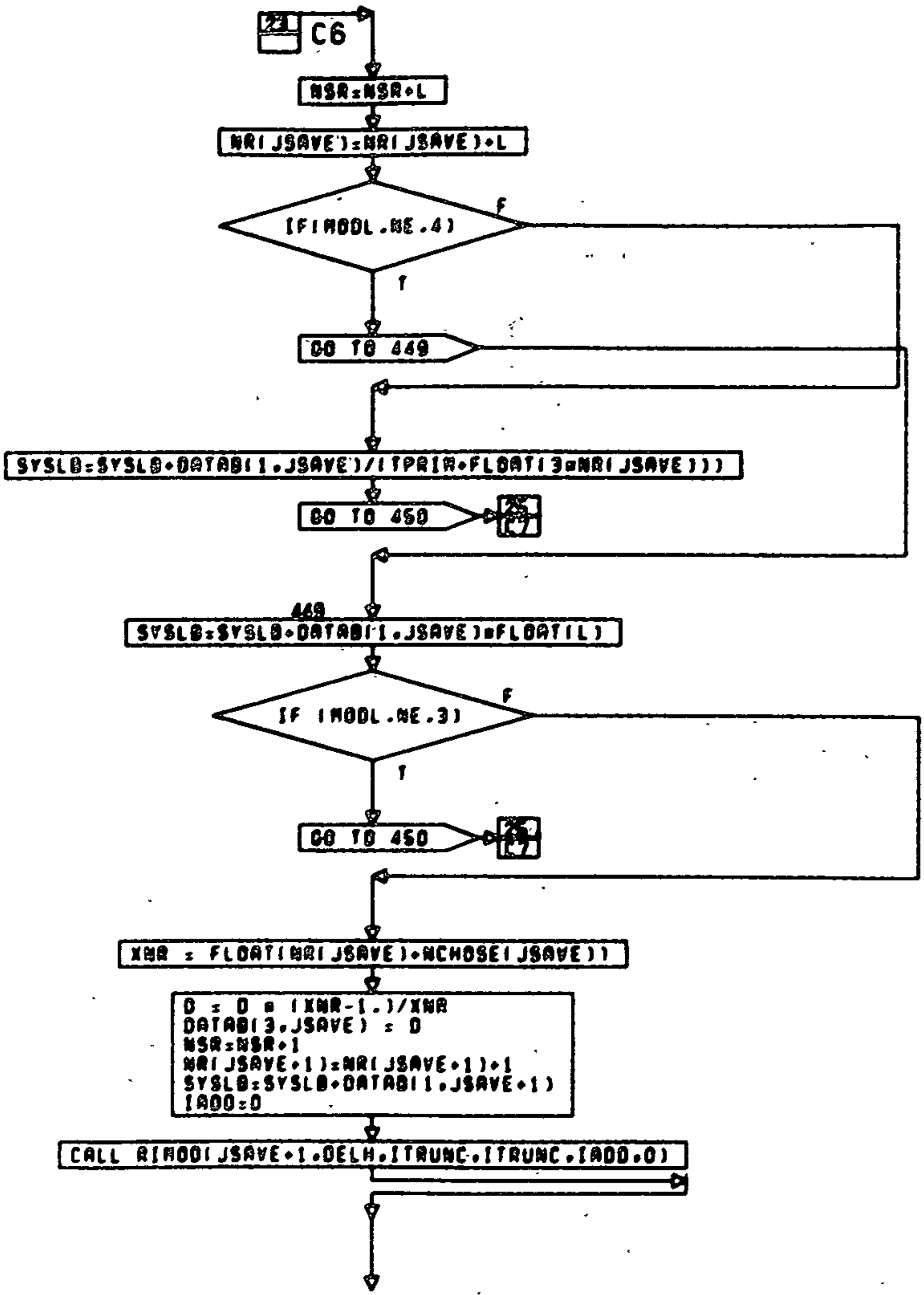
CONT. ON PG 22


C RHO MODE
21 C3
410
CALL OSF (DELW,RNEW,Z,ITRUNC)
RHONEW=Z(ITRUNC)*RFIXED
RHO=(ABS(RHONEW-RHOOLD))/COST(J)
C SELECTION, DECISION SEQUENCE
21 C4
420
IF (RHO.LT.OLDRHO)
F
T
GO TO 440
C RHO.LT.OLDRHO SAVE CURRENT
C RELIABILITY DATA, MODULE NUM,
C AND VALUE OF RHO.
JSAVE=J
OLDRHO=RHO
PRINT 422,JSAVE,OLDRHO,RNEW(ITRUNC)
422
FORMAT (1X,I5,1X,2(E11.4,1X))
DO 430 IND=1,NT
23
I=ITRUNC+1-IND
SAVR(I)=R(I)

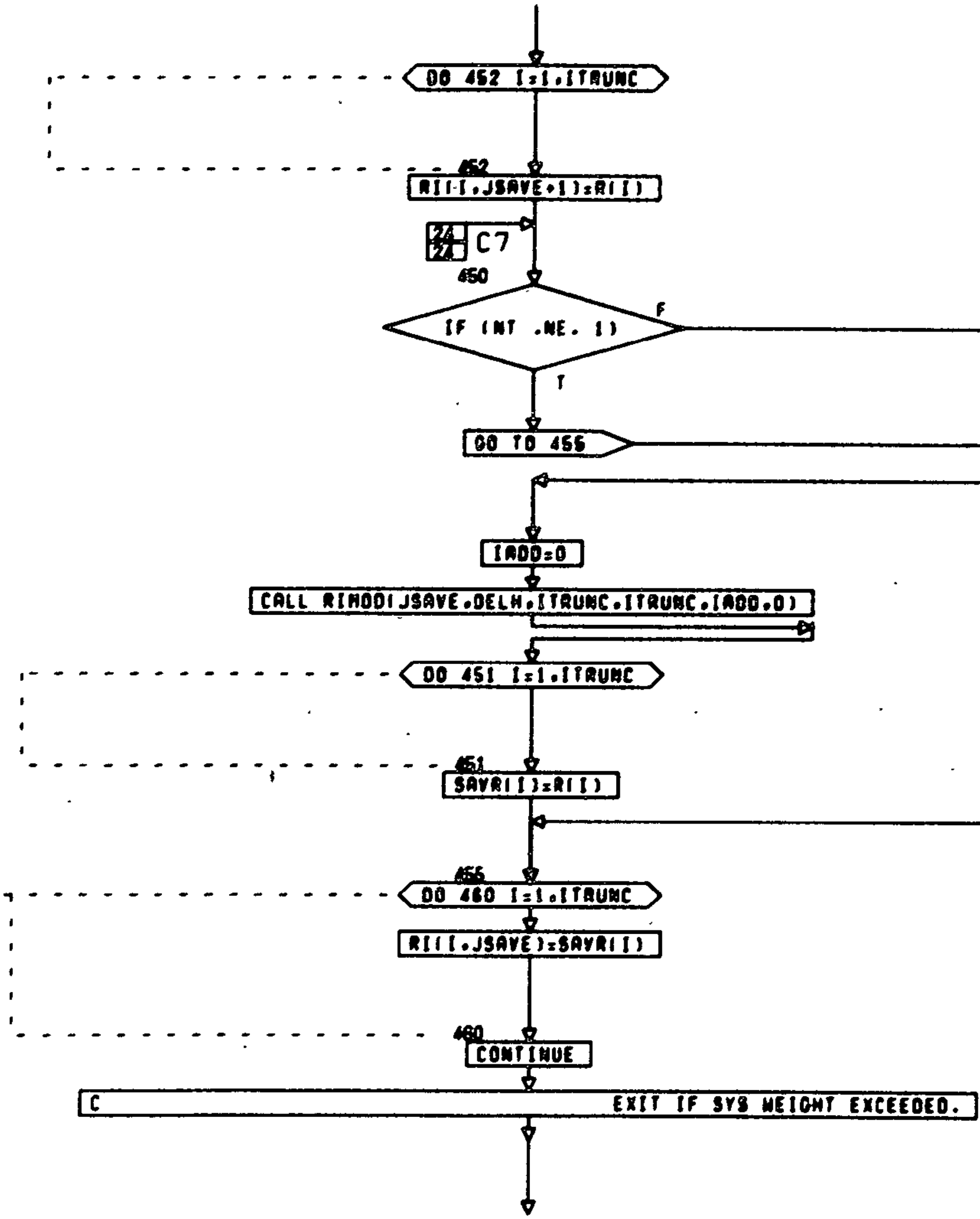
CONT. ON PG 23


22
430
CONTINUE
IF (INT.NE.1)
F
T
SAVRHO=RHONEW
22
20
21
C5
20
440
CONTINUE
IF (OLDRHO.LT.RHOTH)
F
T
GO TO (530,540), IRTN
27
D2
27
D3
C *** END REDAP ***
C ....
C *** SYSTEM RELIABILITY UPDATE PROCEDURE ***
C (SYRUP)
MODL=DATAB(2,JSAVE)+.1
L=1
IF (MODL.EQ.5)
F
T
24
C5
L=NCHOSE(JSAVE)

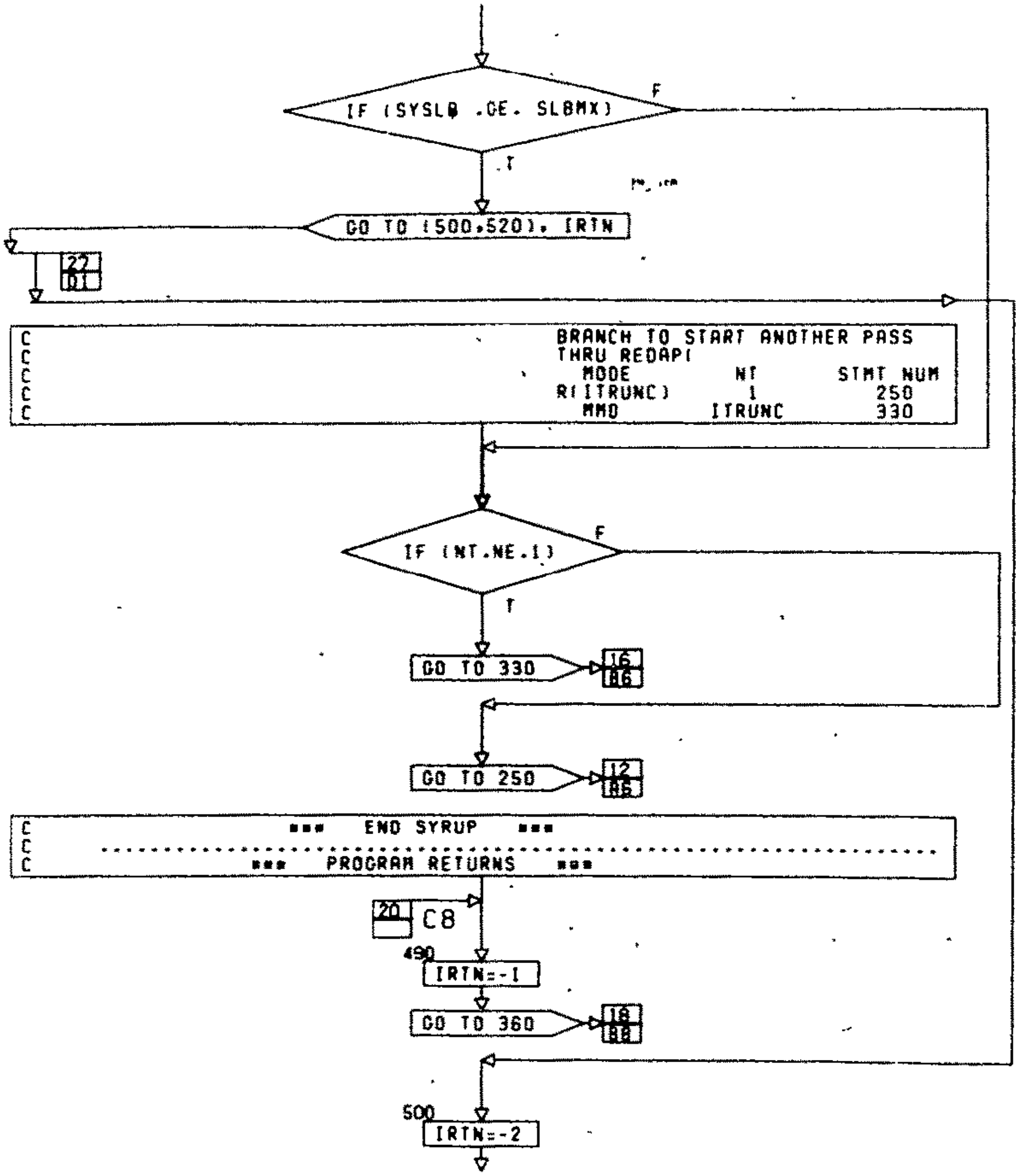
CONT. ON PG 24


24
C6
NSR=NSR+L
NR(JSAVE)=NR(JSAVE)+L
IF(IMODL.NE.4)
F
T
GO TO 449
SYSLB=SYSLB+DATAB(1,JSAVE)/(TPRIM+FLOAT(3*NR(JSAVE)))
GO TO 450
25
C7
449
SYSLB=SYSLB+DATAB(1,JSAVE)*FLOAT(L)
IF (IMODL.NE.3)
F
T
GO TO 450
25
C7
XNR = FLOAT(NR(JSAVE)+NCHOSE(JSAVE))
D = D * (XNR-1.)/XNR
DATAB(3,JSAVE) = D
NSR=NSR+1
NR(JSAVE+1)=NR(JSAVE+1)+1
SYSLB=SYSLB+DATAB(1,JSAVE+1)
IADD=0
CALL RIMOD(JSAVE+1,DELH,ITRUNC,ITRUNC,IADD,0)

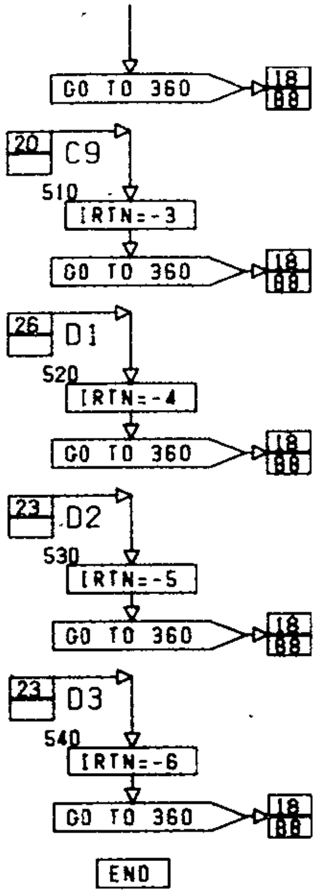
CONT. ON PG 25


DO 452 I=1,ITRUNC
452
R(I,JSAVE+1)=R(I)
24
24
C7
450
IF (NT .NE. 1)
F
T
GO TO 456
IADD=0
CALL RIMOD(JSAVE,DELH,ITRUNC,ITRUNC,IADD,0)
DO 451 I=1,ITRUNC
451
SAVR(I)=R(I)
456
DO 460 I=1,ITRUNC
R(I,JSAVE)=SAVR(I)
460
CONTINUE
C EXIT IF SYS WEIGHT EXCEEDED.

CONT. ON PG 28


IF (SYSLB .GE. SLBMX)
F
T
GO TO (500,520), IRTN
27
D1
C BRANCH TO START ANOTHER PASS
C THRU REDAP(
C MODE NT STMT NUM
C R(ITRUNC) 1 250
C MMD ITRUNC 330
IF (NT.NE.1)
F
T
GO TO 330
16
B6
GO TO 250
12
B6
C *** END SYRUP ***
C ....
C *** PROGRAM RETURNS ***
20
C8
490
IRTN=-1
GO TO 360
18
B8
500
IRTN=-2

CONT. ON PG 27


GO TO 360
18
88
20
C9
510
IRTN=-3
GO TO 360
18
88
26
D1
520
IRTN=-4
GO TO 360
18
88
23
D2
530
IRTN=-5
GO TO 360
18
88
23
D3
540
IRTN=-6
GO TO 360
18
88
END

PG 27 FINAL

```
SUBROUTINE RIMOD(J,DELH,ITRUNC,NT,IADD,IOPT)
```

```
COMMON /DBCOM/ R(31),NR(60),RI(31,60),W(31),RD(31),RDUM(31),
               SAVR(31),SAVNRW(31),RNEW(31),NMX(60),SAVMX(60),
               COST(60),DUM(3213)
```

```
COMMON /CHOSE/     COSTM(5,60),      OPIA(11,60),    ,ICHOSE(60),
                   NCHOSE(60),  SYSPAR ( 6,60),    SKD(7,60),
                   THM(4,60)
```

```
COMMON/PRTCOM/   ACCRCY,        AM,         AN,        BF,        BS,
             CDPI(7,2),    CISTAR,       CTOT,      DDTE,        DE,
                 DRIWT,    EQBSTR,     FEEINV,    FEEOPS,      FEER,
                   GSE,      IREL,     ITRUNP,    MMDOLD,NAME(3,60),
                   OPS,    PAYINV,     PAYQUL,      PAYR,        PE,
                   PMP,       PMR,   POWER(6),        PU,   PWR(60),
                   QCP,       QCR,   ROLD(60),    SABMWT,    SATADP,
                SATINV,      SATR,       SEIP,      SEIR,  SKTAU(6),
```

```
             SSREL(6),   SUBE(7),   SUBT(7), SUBUE(7), SUBUP(7),
                   TA, TAU(6,6),      XDUM1,        TC,        TE,
                   TF,    TOOLR,      TOOLU,    TOTOPS,     TRUNC,
                   TS,      TTT,VOLUME(6), VOL(60),WEIGHT(6),
                XLTOT,     XMEH,     XMEINV,      XMEL,     XMEVL,
                 XMEW,    XMEWT,      XVEST
```

```
REAL LAM,LAMBAR,LAMS
```

```
C      ..................................................................
C         SUBROUTINE RIMOD
C         PURPOSE
C            TO COMPUTE THE RELIABILITY FUNCTION FOR MODULE J AFTER
C            REDUNDANCIES ARE ADDED TO THE MODULE.
C         USAGE
C            CALL RIMOD(R,NR,J,DELH,ITRUNC,NT,IADD,IOPT)
C         DESCRIPTION OF PARAMETERS
```

```
C            J       -INPUT MODULE NUM
C            DELH    -DELTA TIME. THE TIME INCREMENT
C            ITRUNC  -THE NUM OF TIME POINTS
C            NT      -INPUT OPTION PARAMETER
C            IADD    -INPUT OPTION PARAMETER
C            IOPT    -INPUT OPTION PARAMETER
C         REMARKS
C            OPTION PARAMETER  VALUE      ACTION
```

```
C               NT              1        ONLY COMPUTE RELIABILITY AT
C                                        TRUNCATION TIME. RETURN VALUE IN
C                                        R(ITRUNC).
C                             ITRUNC     COMPUTE RELIABILITY AT EACH TIME
C                                        RETURN VALUES IN R.
C              IADD             0        ADD NO REDUNDANCIES BEFORE COM-
C                                        PUTING THE RELIABILITY FUNCTION.
C                               1        ADD REDUNDANCIES BEFORE COMPUT-
```

CONT. ON PG 2

```
C                                          ING THE RELIABILITY FUNCTION.
C                  IOPT            0       UNCOUPLE MODELS 1 AND 3.
C                               OTHER      COUPLE MODELS 1 AND 3.
C          GLOBAL VARIABLES PASSED THOUGH COMMON
C             R       -THE RESULTING RELIABILITY FUNCTION
C             NR      -INPUT VECTOR OF THE NUM OF REDUNDANCIES BY MODULE
C             NCHOS   -INITIAL NUM OF ELEMENTS IN MODULES
C             SYSPAR  -MATRIX OF MODEL PARAMETERS
```

```
C                  SYSPAR(2,J)= MODEL ID FOR J-TH MODULE
C                  FOR FURTHER DESCRIPTION SEE COMMENTS PRECEEDING THE
C                  PARTICULAR MODEL OF INTEREST.
C        SUBROUTINES AND SUBPROGRAMS REQUIRED
C           FORTRAN SYS FNCS% EXP, FLOAT, INT, SQRT
C           EXTERNAL FNCS% GAM=GAMMA FNC, CERF=ERROR FNC
C           SUBROUTINES% NONE
C       .....................................................................
```

```
ROOT2=SQRT(2.0)
MOD=INT(SYSPAR(2,J)+.1)
```

```
GO TO (10,90,120,160,10), MOD
```

8 A8 | 10 A9 | 13 B2

```
C       .....................................................................
C       MODELS 1 AND 5
C          VARIABLES       SIZE      ORIGIN        DEFN
C            LAMS            1         INT         SENSE/SWITCH FAILURE RATE
C             LAM            1         INT         FAILURE RATE
C              Q             1         INT         DORMANCY FACTOR
C             DC             1         INT         MODULE DUTY CYCLE
C             MI             1         INT         NUM OF STANDBY ELEMENTS
```

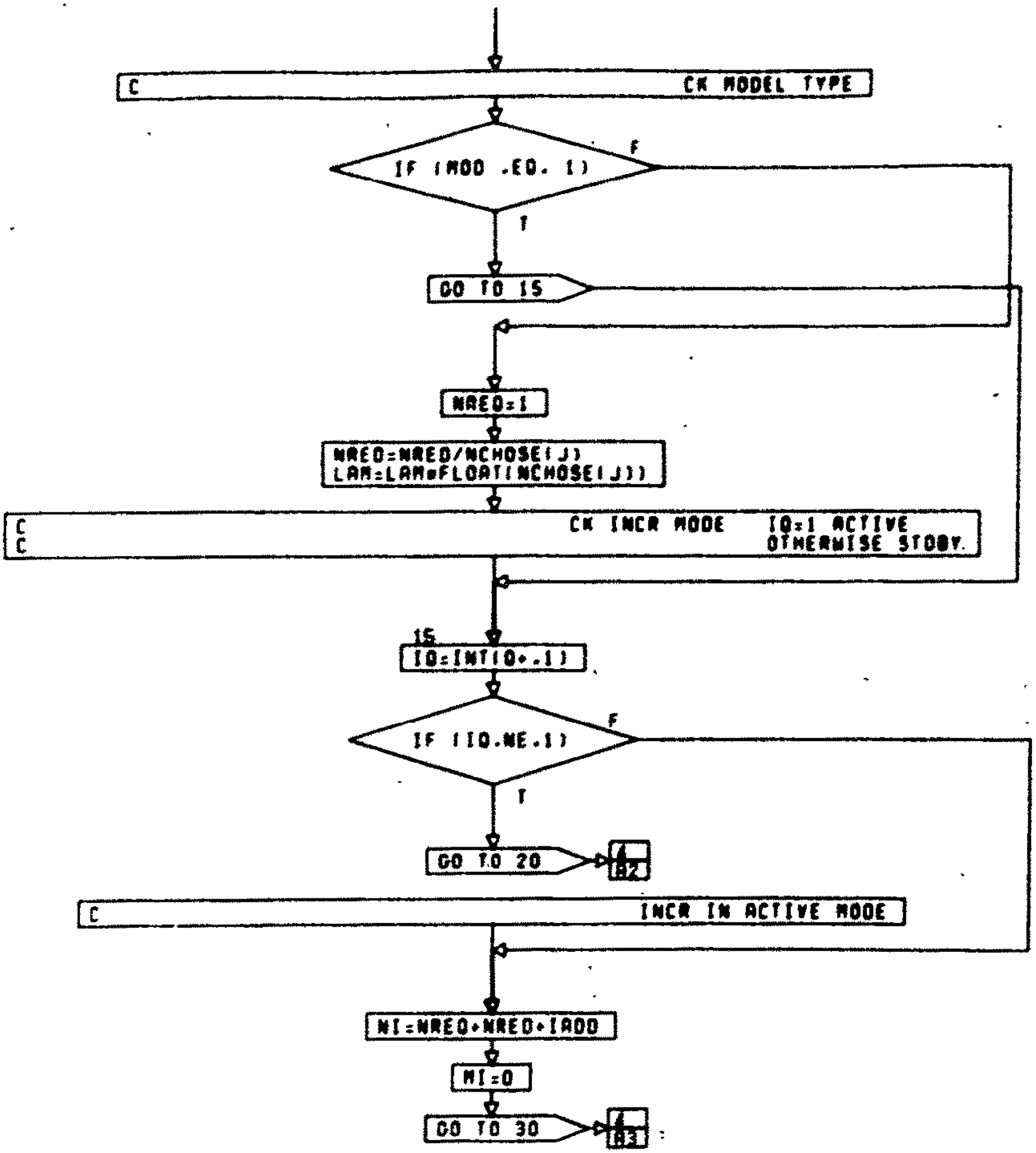
```
C             NI             1         INT         NUM OF ACTIVE ELEMENTS
C           SYSPAR          I,J      GLOBAL        MODEL PARAMETERS FOR J-TH
C                                                  MODULE
C                                                  I=3    VALUE OF LAM
C                                                  I=4    VALUE OF LAMS
C                                                  I=5    VALUE OF Q
C                                                  I=6    VALUE OF DC
C       .....................................................................
```

A1 13

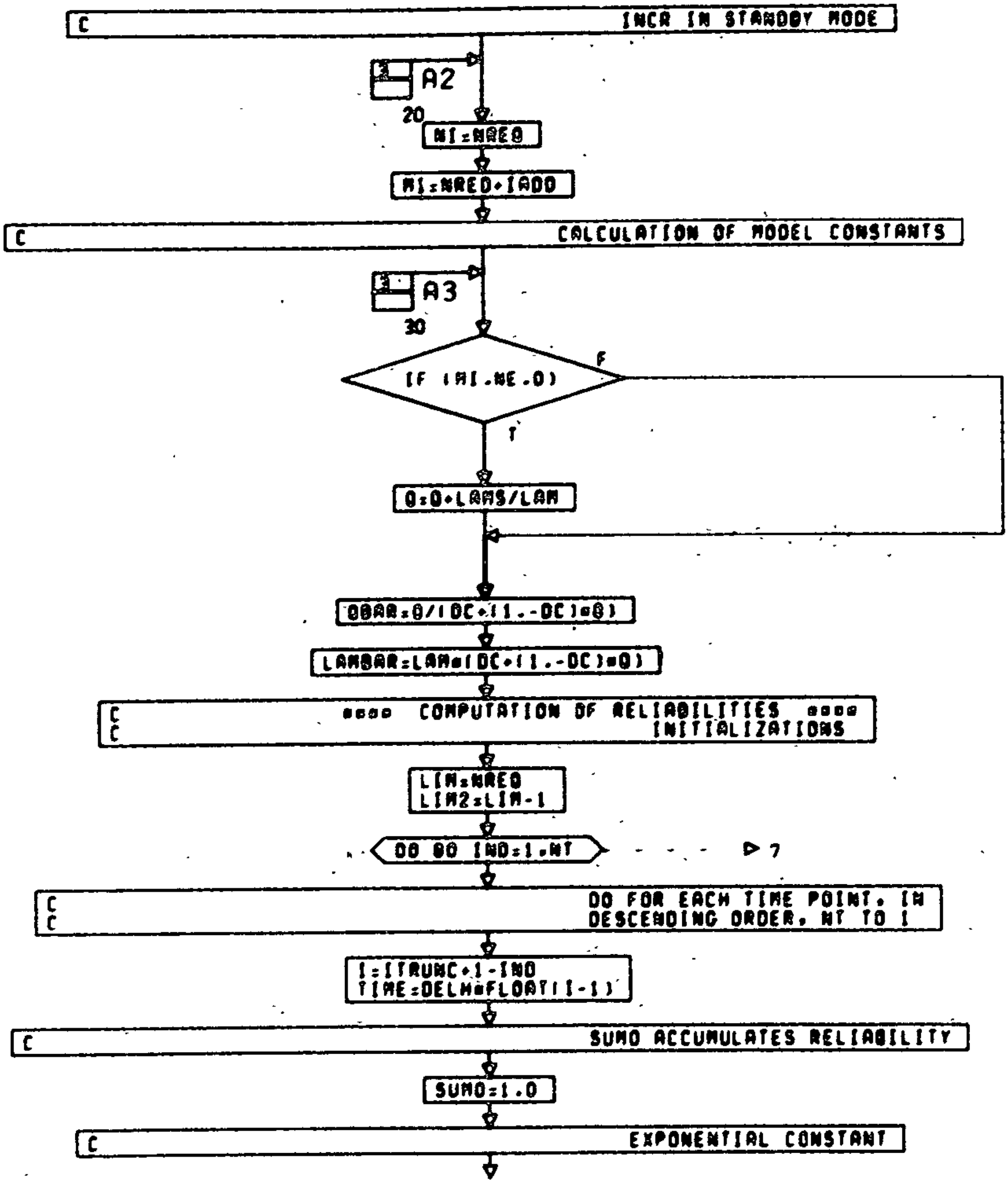
10
```
LAM=SYSPAR(3,J)
```

```
LAMS=SYSPAR(4,J)
Q=SYSPAR(5,J)
DC=SYSPAR(6,J)
NREQ=NCHOSE(J)
NRED=NR(J)
```

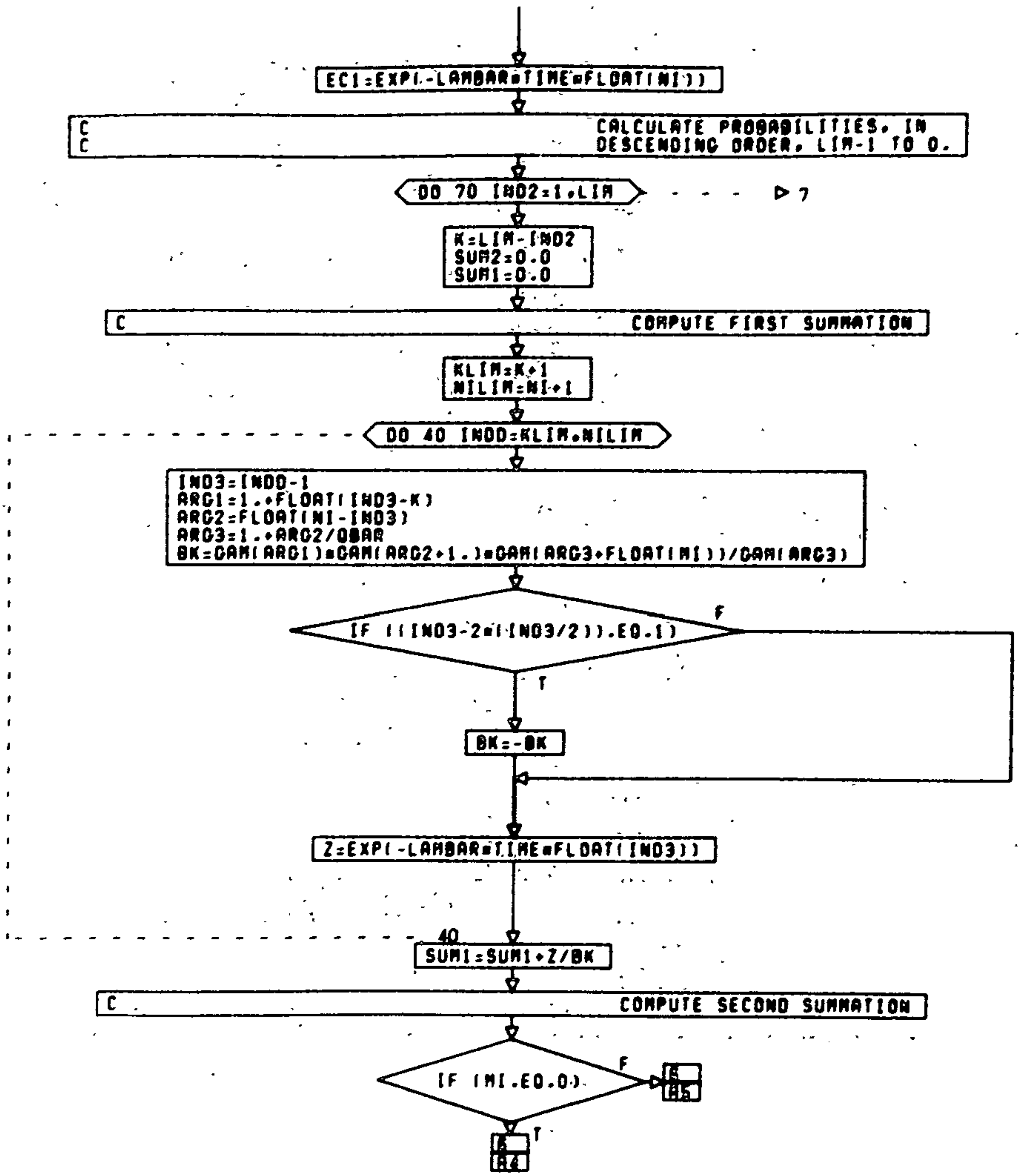
CONT. ON PG 3


C CK MODEL TYPE
IF (MOD .EQ. 1)
F
T
GO TO 15
NREQ=1
NREQ=NREQ/NCHOSE(J)
LAM=LAM*FLOAT(NCHOSE(J))
C CK INCR MODE IQ=1 ACTIVE
C OTHERWISE STDBY.
15
IQ=INT(Q+.1)
IF (IQ.NE.1)
F
T
GO TO 20
4
B2
C INCR IN ACTIVE MODE
NI=NREQ+NREQ+IADD
MI=0
GO TO 30
4
B3

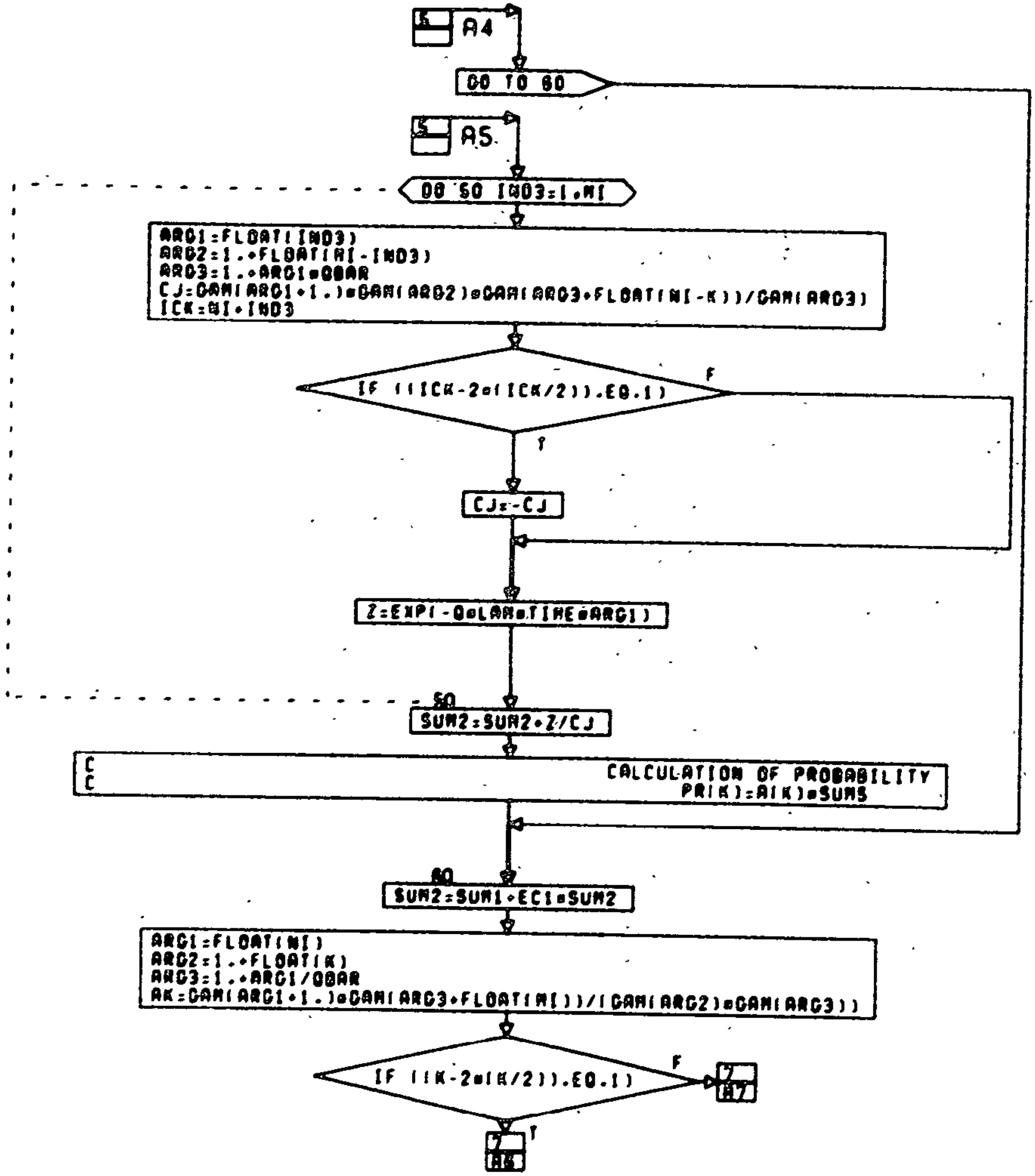
CONT. ON PG 4


C INCR IN STANDBY MODE
A2
20
NI=NRED
NI=NRED+IADD
C CALCULATION OF MODEL CONSTANTS
A3
30
IF (NI.NE.0)
F
T
Q=Q+LAMS/LAM
QBAR=Q/(DC+(1.-DC)*Q)
LAMBAR=LAM*(DC+(1.-DC)*Q)
C **** COMPUTATION OF RELIABILITIES ****
C INITIALIZATIONS
LIM=NRED
LIM2=LIM-1
DO 80 IND=1,NT
7
C DO FOR EACH TIME POINT, IN
C DESCENDING ORDER, NT TO 1
I=ITRUNC+1-IND
TIME=DELM*FLOAT(I-1)
C SUMO ACCUMULATES RELIABILITY
SUMO=1.0
C EXPONENTIAL CONSTANT

CONT. ON PG 5

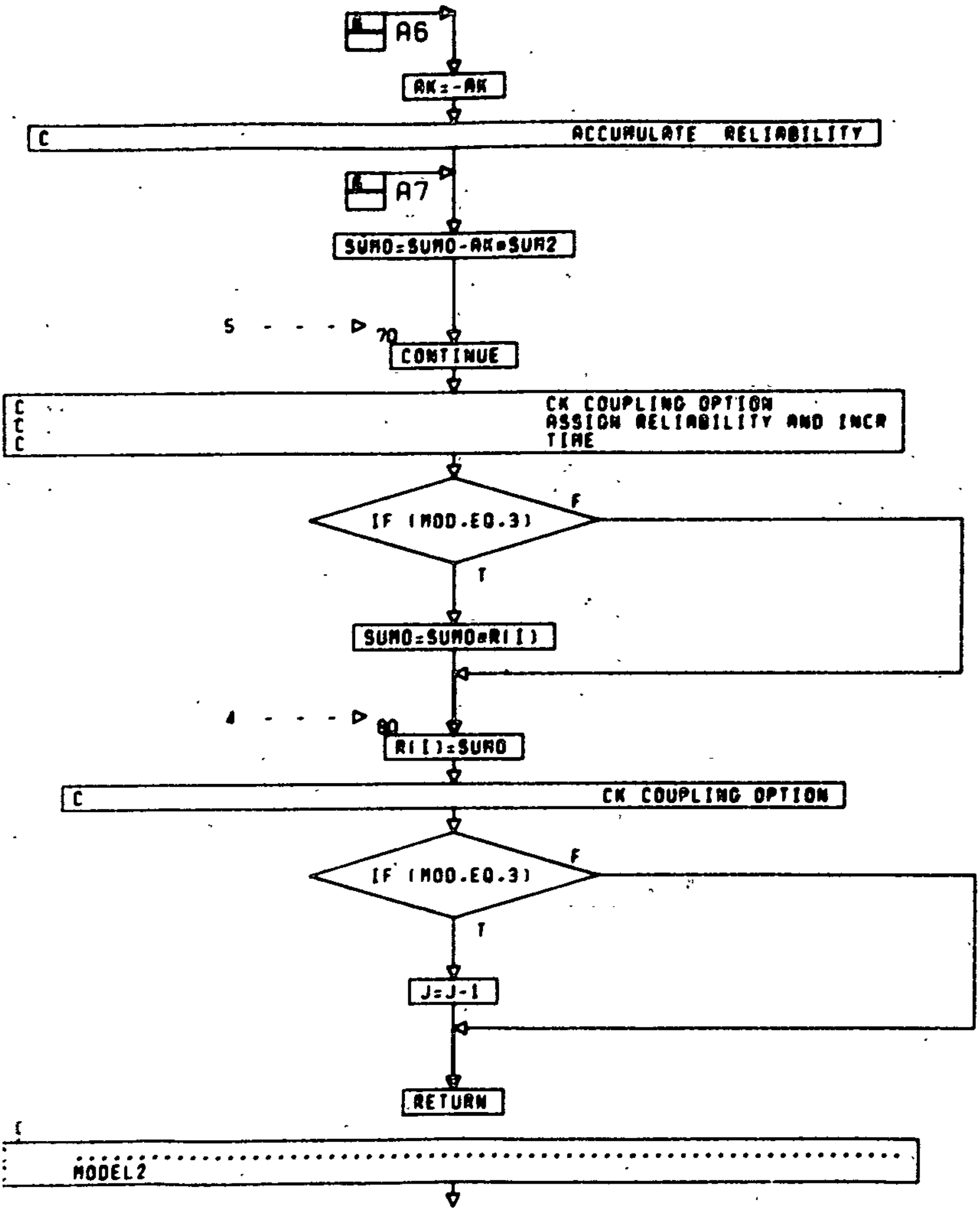

EC1=EXP(-LAMBAR*TIME*FLOAT(NI))
C CALCULATE PROBABILITIES, IN
C DESCENDING ORDER, LIM-1 TO 0.
DO 70 IND2=1,LIM
7
K=LIM-IND2
SUM2=0.0
SUM1=0.0
C COMPUTE FIRST SUMMATION
KLIM=K+1
NILIM=NI+1
DO 40 INDD=KLIM,NILIM
IND3=INDD-1
ARG1=1.+FLOAT(IND3-K)
ARG2=FLOAT(NI-IND3)
ARG3=1.+ARG2/QBAR
BK=GAM(ARG1)*GAM(ARG2+1.)*GAM(ARG3+FLOAT(NI))/GAM(ARG3)
IF ((IND3-2*(IND3/2)).EQ.1)
F
T
BK=-BK
Z=EXP(-LAMBAR*TIME*FLOAT(IND3))
40
SUM1=SUM1+Z/BK
C COMPUTE SECOND SUMMATION
IF (NI.EQ.0)
F
6
A5
T
6
A4

CONT. ON PG 6

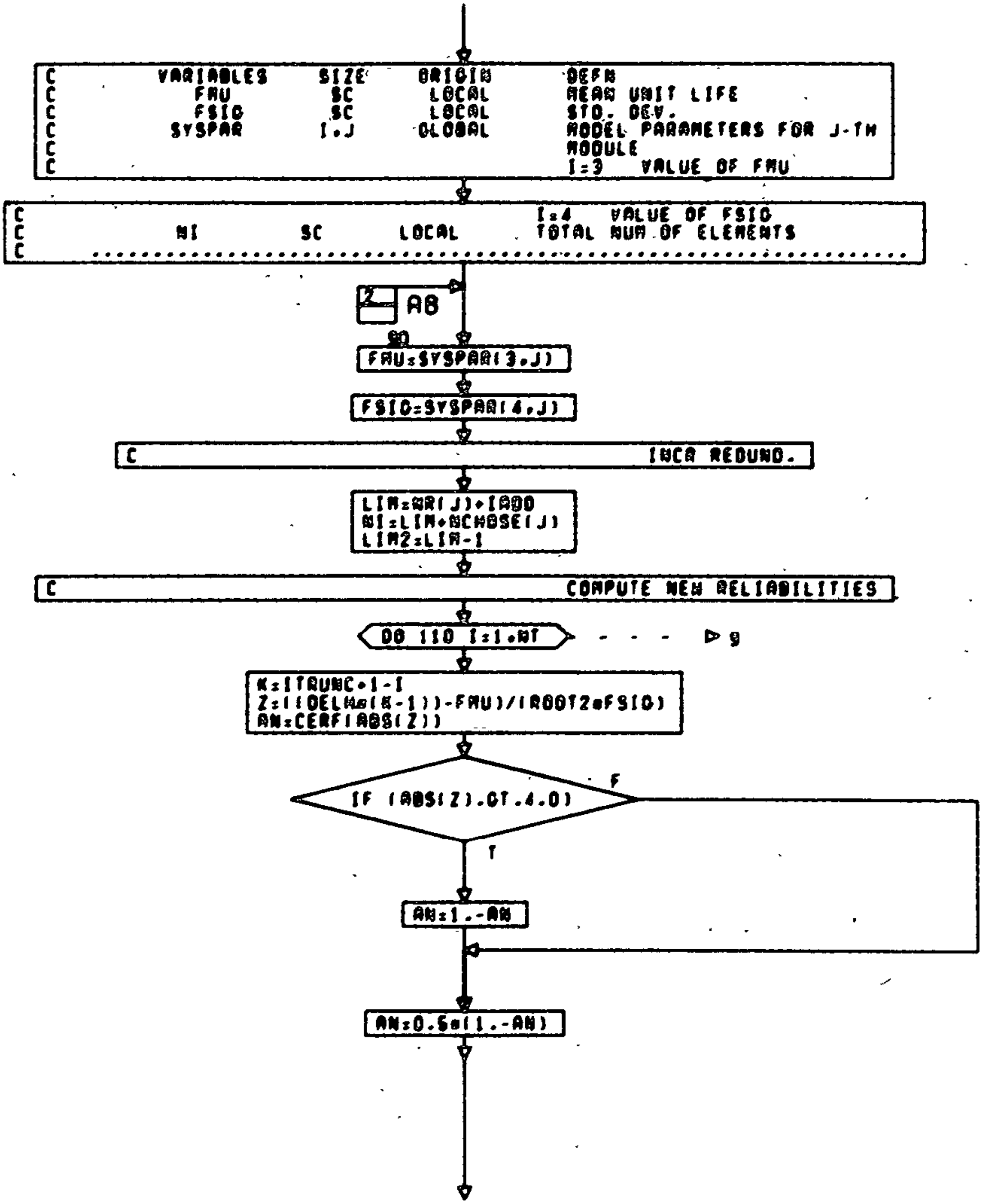


6
A4
GO TO 60
5
A5
DO 50 IND3=1,NI
ARG1=FLOAT(IND3)
ARG2=1.+FLOAT(NI-IND3)
ARG3=1.+ARG1*QBAR
CJ=GAM(ARG1+1.)*GAM(ARG2)*GAM(ARG3+FLOAT(NI-K))/GAM(ARG3)
ICK=NI+IND3
IF ((ICK-2*(ICK/2)).EQ.1)
F
T
CJ=-CJ
Z=EXP(-Q*LAM*TIME*ARG1)
50
SUM2=SUM2+Z/CJ
C
C
CALCULATION OF PROBABILITY
PR(K)=A(K)*SUMS
60
SUM2=SUM1+EC1*SUM2
ARG1=FLOAT(NI)
ARG2=1.+FLOAT(K)
ARG3=1.+ARG1/QBAR
AK=GAM(ARG1+1.)*GAM(ARG3+FLOAT(NI))/(GAM(ARG2)*GAM(ARG3))
IF ((K-2*(K/2)).EQ.1)
F
7
A7
T
7
A6

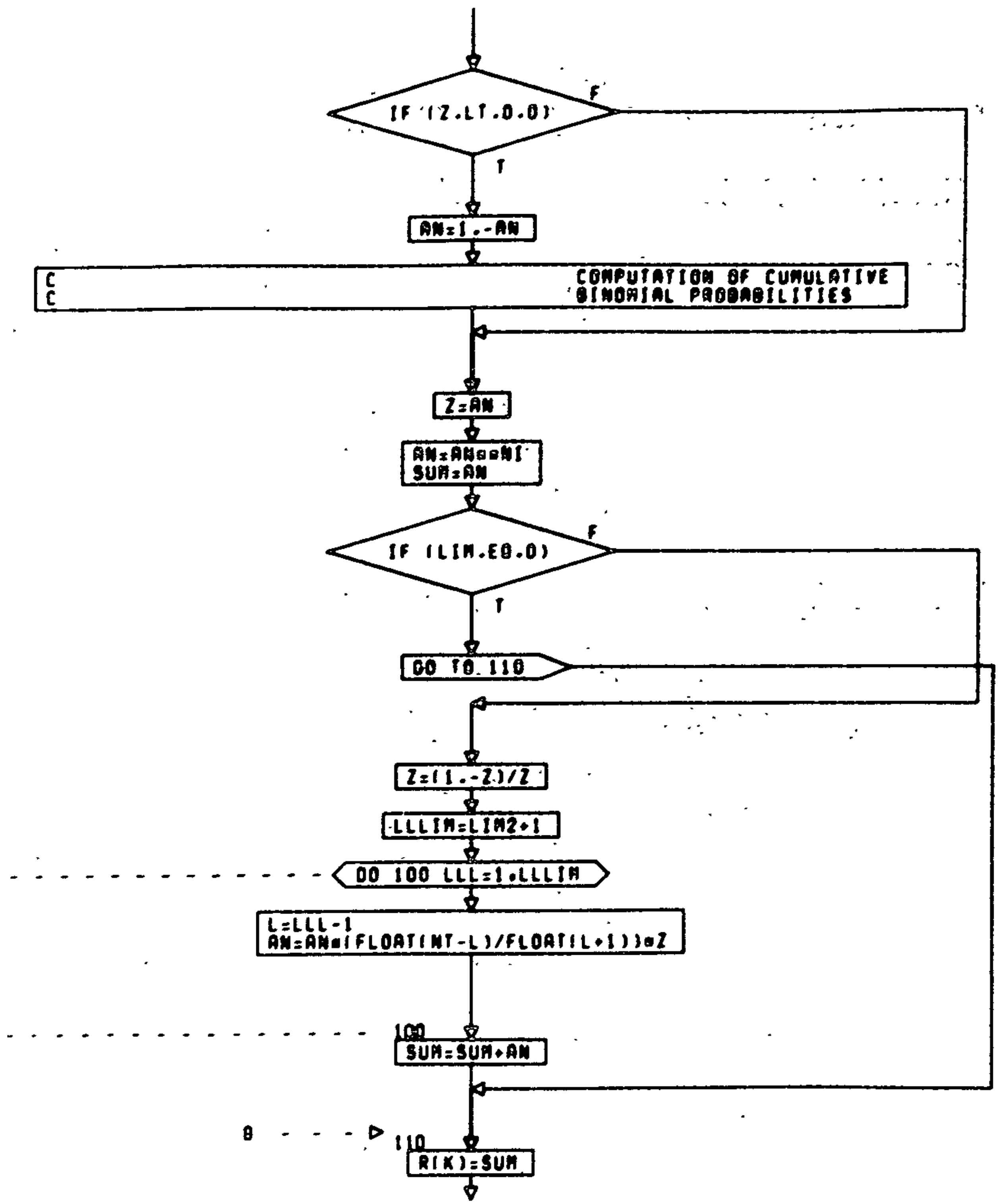
CONT. ON PG 7


A6
AK=-AK
C ACCUMULATE RELIABILITY
A7
SUMO=SUMO-AK*SUM2
5
70
CONTINUE
C CK COUPLING OPTION
C ASSIGN RELIABILITY AND INCR
C TIME
IF (MOD.EQ.3)
F
T
SUMO=SUMO*R(I)
4
80
R(I)=SUMO
C CK COUPLING OPTION
IF (MOD.EQ.3)
F
T
J=J-1
RETURN
C
MODEL2

CONT. ON PG 8


C VARIABLES SIZE ORIGIN DEFN
C FMU SC LOCAL MEAN UNIT LIFE
C FSIG SC LOCAL STD. DEV.
C SYSPAR I,J GLOBAL MODEL PARAMETERS FOR J-TH
C MODULE
C I=3 VALUE OF FMU
C I=4 VALUE OF FSIG
C NI SC LOCAL TOTAL NUM OF ELEMENTS
C ....
2 A8
90
FMU=SYSPAR(3,J)
FSIG=SYSPAR(4,J)
C INCR REDUND.
LIM=NR(J)+IADD
NI=LIM+NCHOSE(J)
LIM2=LIM-1
C COMPUTE NEW RELIABILITIES
DO 110 I=1,NT
9
K=ITRUNC+1-I
Z=((DELM*(K-1))-FMU)/(ROOT2*FSIG)
AN=CERF(ABS(Z))
IF (ABS(Z).GT.4.0)
F
T
AN=1.-AN
AN=0.5*(1.-AN)

CONT. ON PG 9


IF (Z.LT.0.0)
F
T
AN=1.-AN
C COMPUTATION OF CUMULATIVE
C BINOMIAL PROBABILITIES
Z=AN
AN=AN**NI
SUM=AN
IF (LIM.EQ.0)
F
T
GO TO 110
Z=(1.-Z)/Z
LLLIM=LIM2+1
DO 100 LLL=1,LLLIM
L=LLL-1
AN=AN*(FLOAT(NT-L)/FLOAT(L+1))*Z
100
SUM=SUM+AN
8
110
R(K)=SUM

CONT. ON PG 10

```
RETURN
```

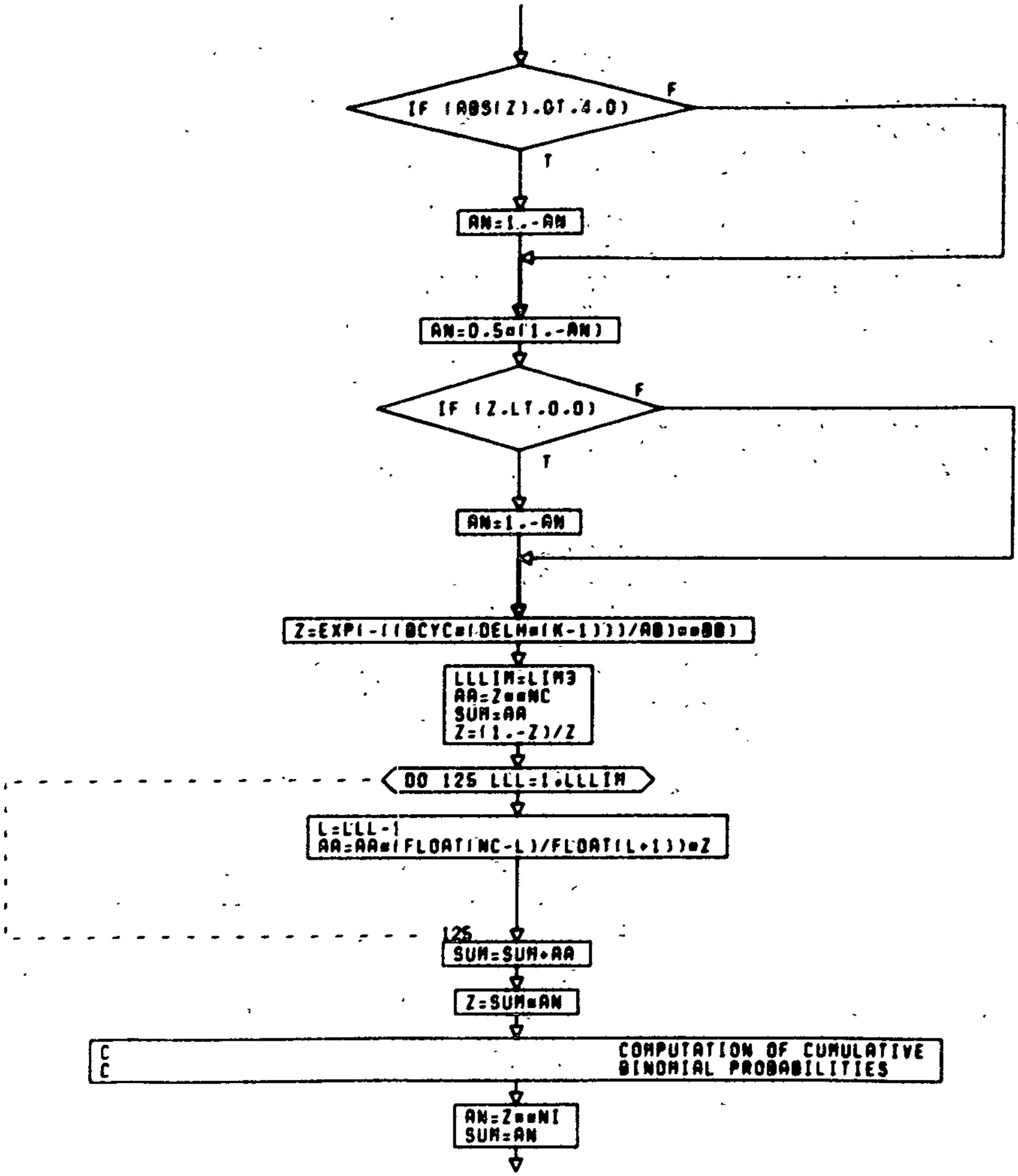
```
C      ...........................................................................
C      MODEL3:
C          VARIABLES       SIZE       ORIGIN          DEFN
C              D            SC         LOCAL          DEPTH OF DISCHARGE
C              TB           SC         LOCAL          BATTERY TEMPERATURE
C              AB           SC         LOCAL          BATTERY CELL CONSTANT
C              BB           SC         LOCAL          BATTERY CELL CONSTANT
C             BCYC          SC         LOCAL          CYCLE RATE OF BATTERY
```

```
C              NI           SC         LOCAL          TOTAL NUM OF BATTERIES
C              NC           SC         LOCAL          NUM OF CELLS IN BATTERY
C            SYSPAR         I,J        GLOBAL         MODEL PARAMETERS FOR J-TH
C                                                     MODULE
C                                                     I=3    VALUE OF D
C                                                     I=4    VALUE OF TB
C                                                     I=5    VALUE OF BCYC
C                                                     I=6    VALUE OF NC
```

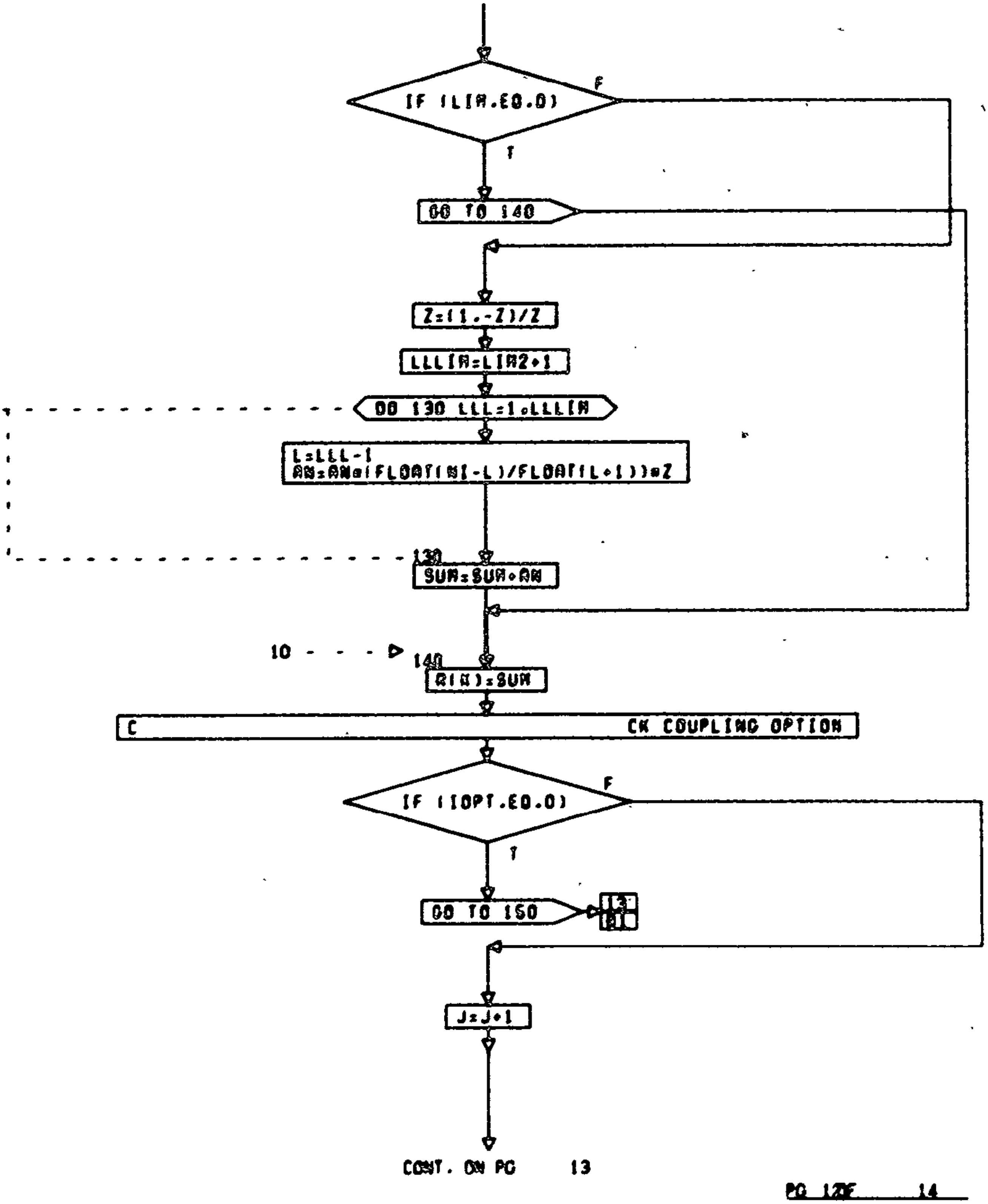
```
C      ...........................................................................
```

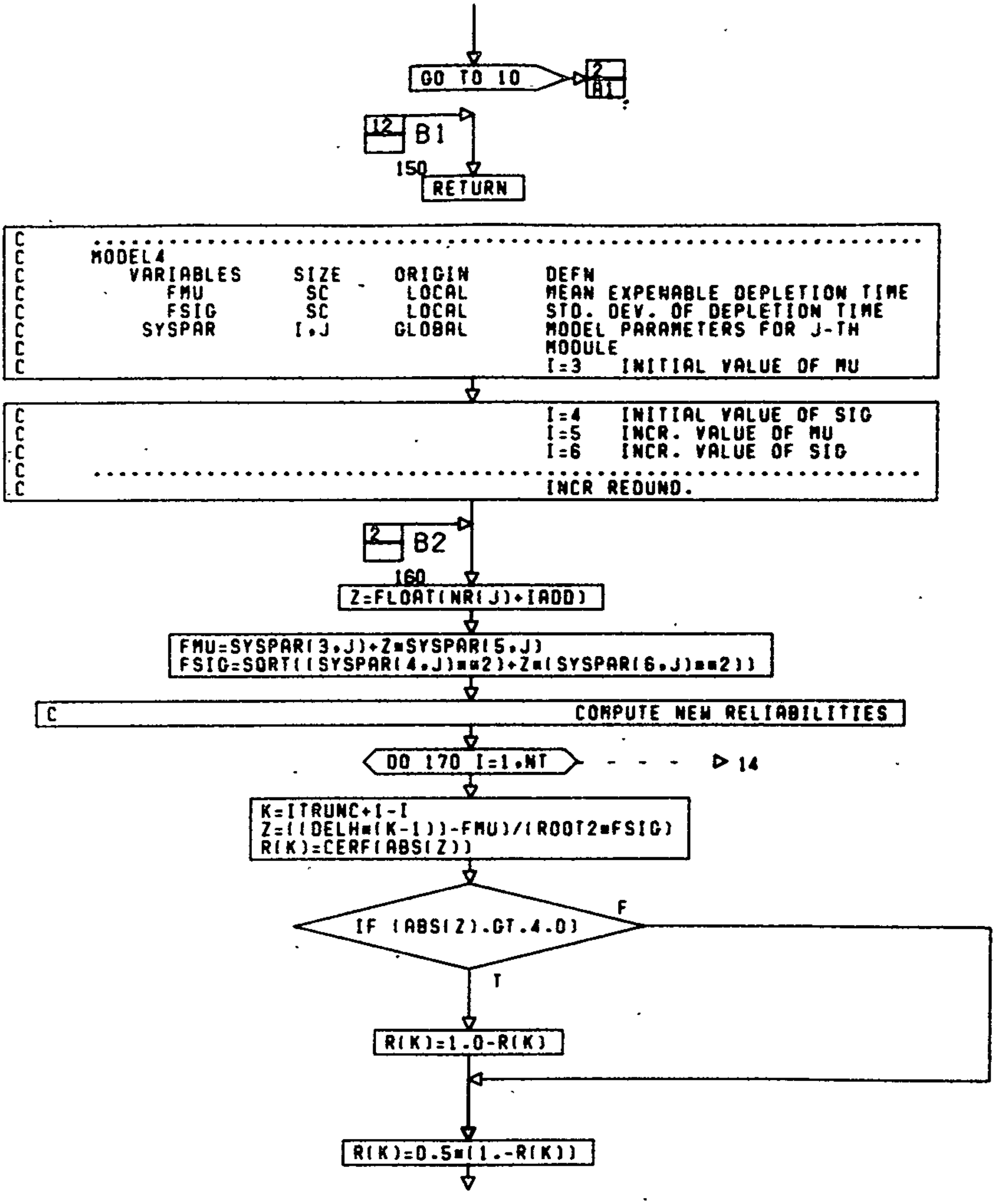
```
2  A9

120
BCYC = SYSPAR(5,J)

NC=SYSPAR(6,J)+.1

C                                                          INCR REDUND.

LIM=NR(J)+IADD
NI=LIM+NCHOSE(J)
LIM2=LIM-1
D = SYSPAR(3,J) * FLOAT(NI-IADD) / FLOAT(NI)
TB = SYSPAR(4,J)
LIM3=NC/2
NC=NC+LIM3

AB=EXP(-11.380050+.23096921*TB-.54906583*D-.00050846174*TB*TB
   +.019307737*D*D-.0002374105*D**3)

BB=EXP(-130.10332+.95927099*TB-.18704227*D-.0016717706*TB*TB
   -.0019619976*D*D+.0011242600*TB*D)

C                                                COMPUTE NEW RELIABILITIES

DO 140 I=1,NT    - - -  > 12

K=ITRUNC+1-I
Z=(DELH*(K-1)-87660.)/(17532.*ROOT2)
AN=CERF(ABS(Z))
```

CONT. ON PG 11

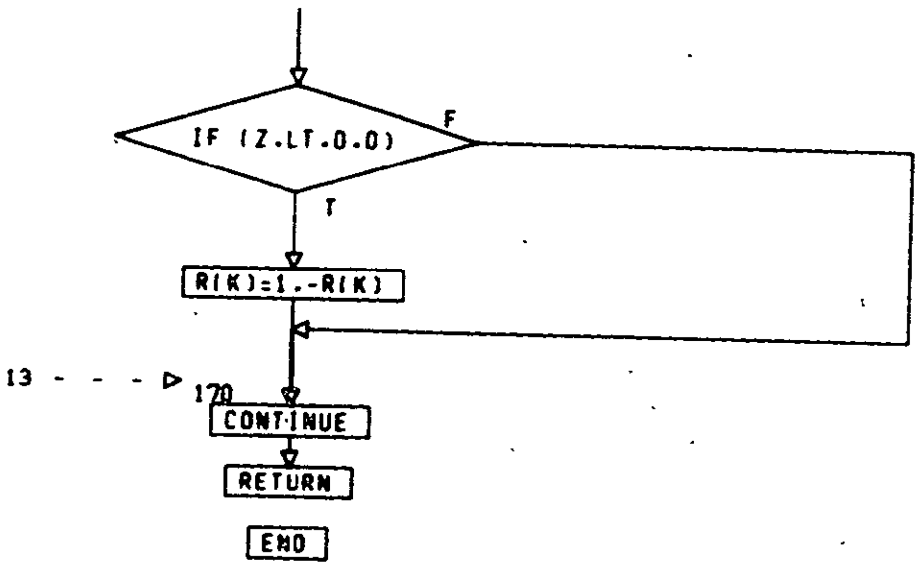

IF (ABS(Z).GT.4.0)
F
T
AN=1.-AN
AN=0.5*(1.-AN)
IF (Z.LT.0.0)
F
T
AN=1.-AN
Z=EXP(-((BCYC*(DELM*(K-1)))/AB)**BB)
LLLIM=LIM3
AA=Z**NC
SUM=AA
Z=(1.-Z)/Z
DO 125 LLL=1,LLLIM
L=LLL-1
AA=AA*(FLOAT(NC-L)/FLOAT(L+1))*Z
125
SUM=SUM+AA
Z=SUM*AN
C COMPUTATION OF CUMULATIVE
C BINOMIAL PROBABILITIES
AN=Z**NI
SUM=AN

CONT. ON PG 12


IF (LIM.EQ.0)
F
T
GO TO 140
Z=(1.-Z)/Z
LLLIM=LIM2+1
DO 130 LLL=1,LLLIM
L=LLL-1
AN=AN*(FLOAT(NI-L)/FLOAT(L+1))*Z
130
SUM=SUM+AN
10
140
A(N)=SUM
C
CK COUPLING OPTION
IF (IOPT.EQ.0)
F
T
GO TO 150
13
B1
J=J+1
CONT. ON PG 13
PG 12OF 14


GO TO 10
2
B1
12
B1
150
RETURN
C ....
C MODEL4
C VARIABLES SIZE ORIGIN DEFN
C FMU SC LOCAL MEAN EXPENABLE DEPLETION TIME
C FSIG SC LOCAL STD. DEV. OF DEPLETION TIME
C SYSPAR I,J GLOBAL MODEL PARAMETERS FOR J-TH
C MODULE
C I=3 INITIAL VALUE OF MU
C I=4 INITIAL VALUE OF SIG
C I=5 INCR. VALUE OF MU
C I=6 INCR. VALUE OF SIG
C ....
C INCR REDUND.
2
B2
160
Z=FLOAT(NR(J)+IADD)
FMU=SYSPAR(3,J)+Z*SYSPAR(5,J)
FSIG=SQRT((SYSPAR(4,J)**2)+Z*(SYSPAR(6,J)**2))
C COMPUTE NEW RELIABILITIES
DO 170 I=1,NT
14
K=ITRUNC+1-I
Z=((DELH*(K-1))-FMU)/(ROOT2*FSIG)
R(K)=CERF(ABS(Z))
IF (ABS(Z).GT.4.0)
F
T
R(K)=1.0-R(K)
R(K)=0.5*(1.-R(K))

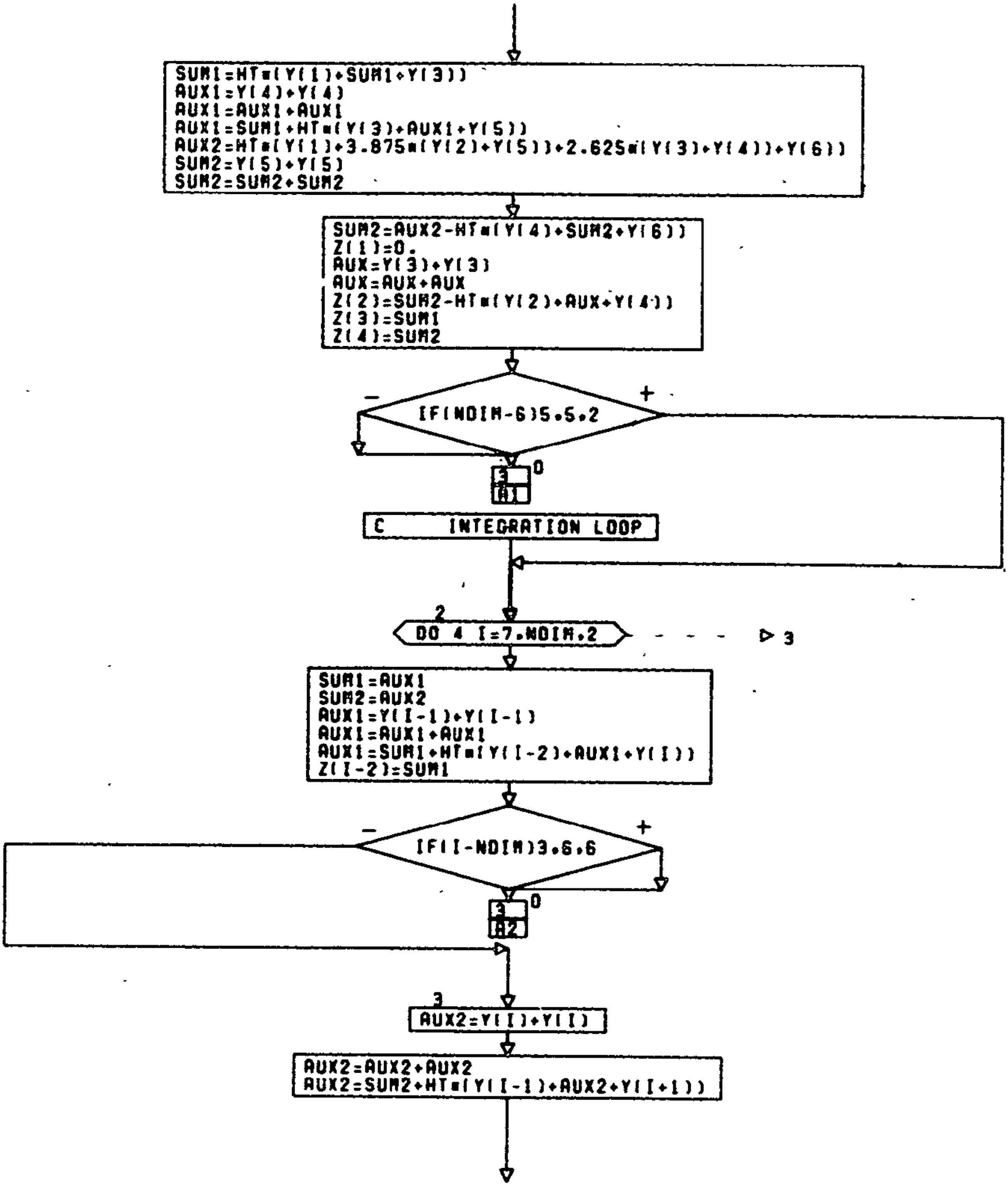
CONT. ON PG 14



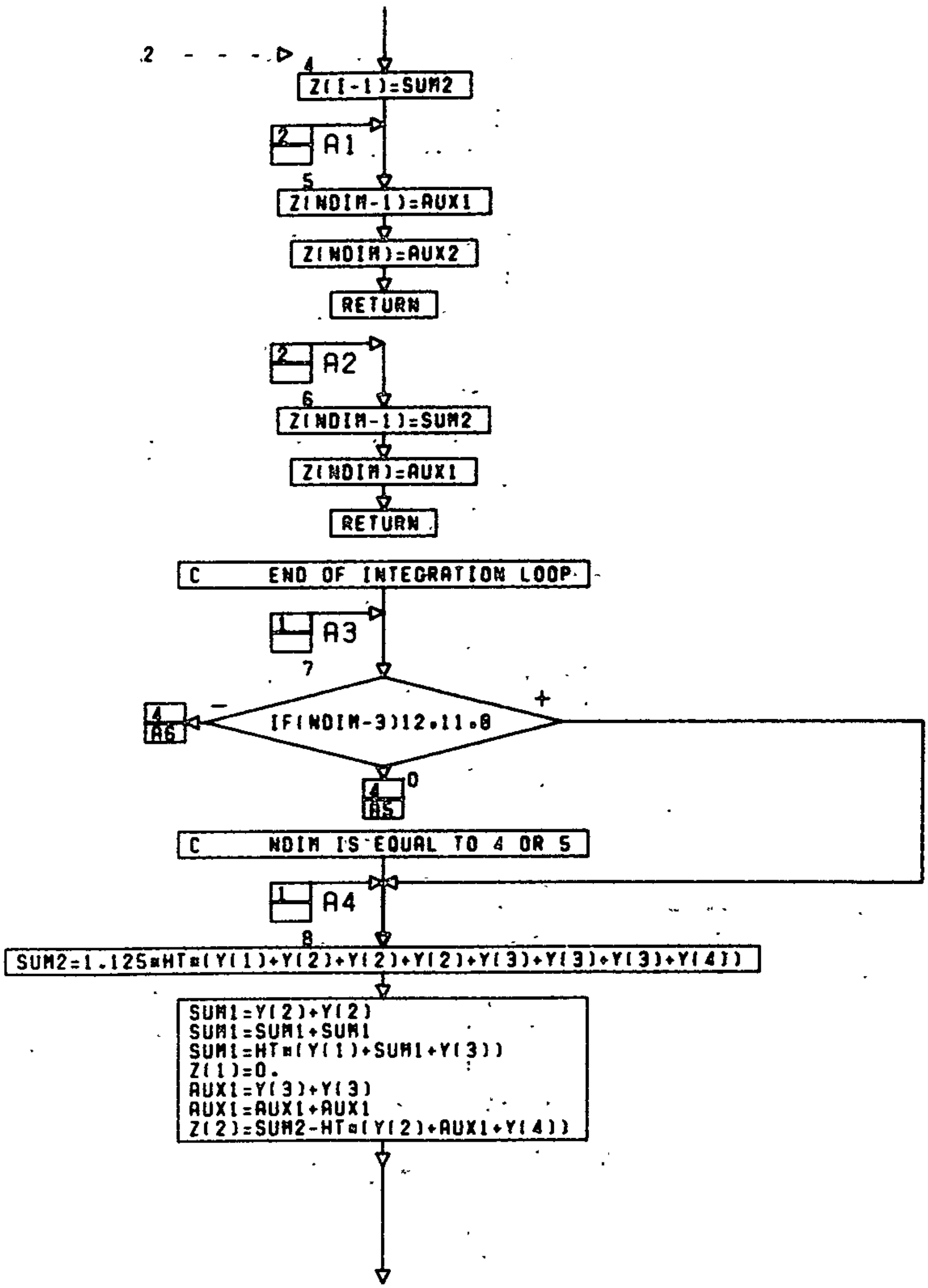
PG 14 FINAL

```
SUBROUTINE QSF(H,Y,Z,NDIM)

C     ..................................................................
C        SUBROUTINE QSF
C        PURPOSE
C           TO COMPUTE THE VECTOR OF INTEGRAL VALUES FOR A GIVEN
C           EQUIDISTANT TABLE OF FUNCTION VALUES.
C        USAGE
C           CALL QSF (H,Y,Z,NDIM)
C        DESCRIPTION OF PARAMETERS

C           H      - THE INCREMENT OF ARGUMENT VALUES.
C           Y      - THE INPUT VECTOR OF FUNCTION VALUES.
C           Z      - THE RESULTING VECTOR OF INTEGRAL VALUES. Z MAY BE
C                    IDENTICAL WITH Y.
C           NDIM   - THE DIMENSION OF VECTORS Y AND Z.
C        REMARKS
C           NO ACTION IN CASE NDIM LESS THAN 3.
C        SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED

C           NONE
C        METHOD
C           BEGINNING WITH Z(1)=0, EVALUATION OF VECTOR Z IS DONE BY
C           MEANS OF SIMPSONS RULE TOGETHER WITH NEWTONS 3/8 RULE OR A
C           COMBINATION OF THESE TWO RULES. TRUNCATION ERROR IS OF
C           ORDER H**5 (I.E. FOURTH ORDER METHOD). ONLY IN CASE NDIM=3
C           TRUNCATION ERROR OF Z(2) IS OF ORDER H**4.
C           FOR REFERENCE, SEE

C           (1) F.B.HILDEBRAND, INTRODUCTION TO NUMERICAL ANALYSIS,
C               MCGRAW-HILL, NEW YORK/TORONTO/LONDON, 1956, PP.71-76.
C           (2) R.ZURMUEHL, PRAKTISCHE MATHEMATIK FUER INGENIEURE UND
C               PHYSIKER, SPRINGER, BERLIN/GOETTINGEN/HEIDELBERG, 1963,
C               PP.214-221.
C     ..................................................................

DIMENSION Y(1),Z(1)
HT=.3333333*H

IF(NDIM-5)7,8,1
   -  -> 3 / A3
   0  -> 3 / A4
   +  -> 1

C     NDIM IS GREATER THAN 5. PREPARATIONS OF INTEGRATION LOOP

1  SUM1=Y(2)+Y(2)
   SUM1=SUM1+SUM1
```

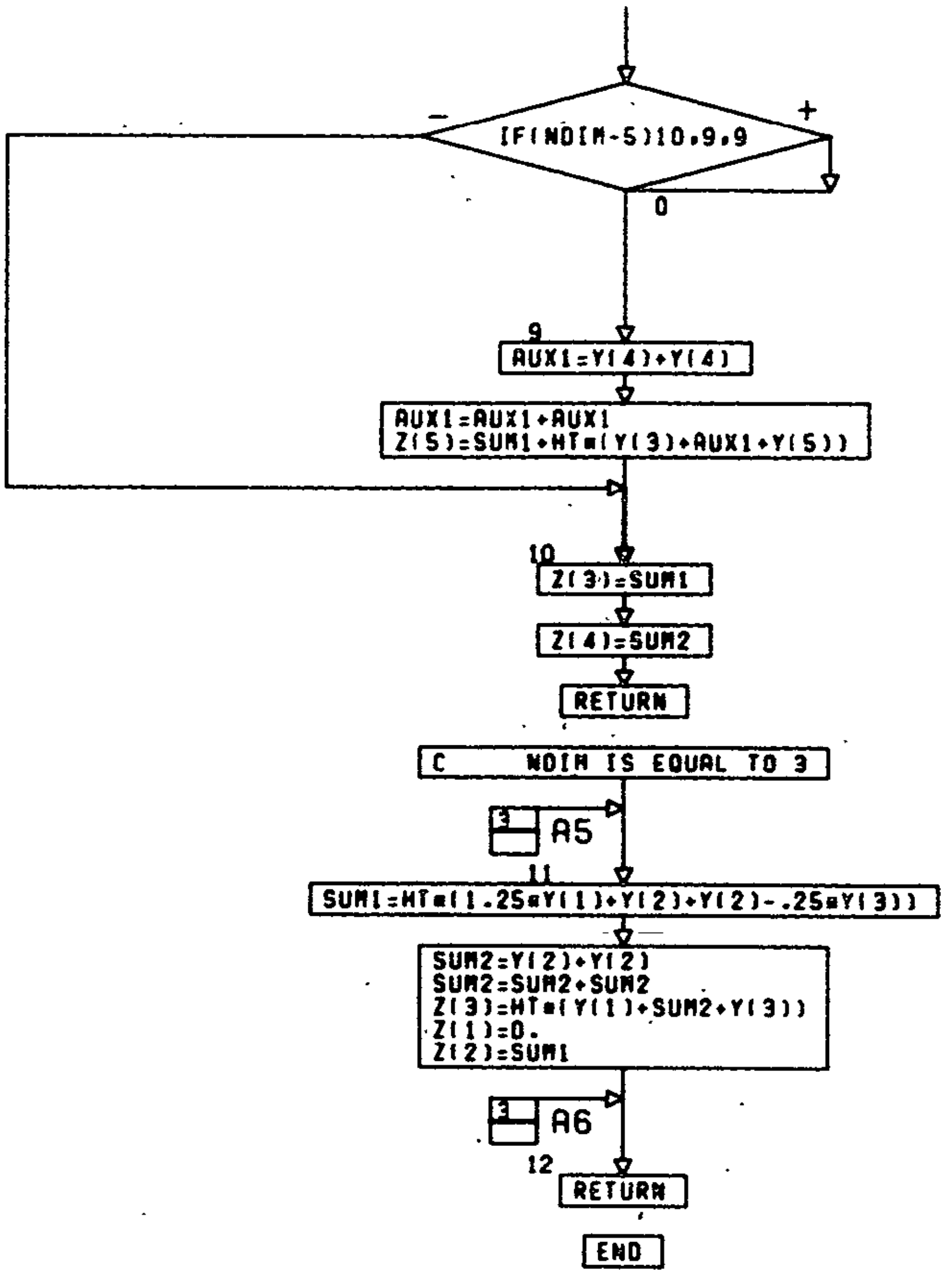
CONT. ON PG 2


SUM1=HT*(Y(1)+SUM1+Y(3))
AUX1=Y(4)+Y(4)
AUX1=AUX1+AUX1
AUX1=SUM1+HT*(Y(3)+AUX1+Y(5))
AUX2=HT*(Y(1)+3.875*(Y(2)+Y(5))+2.625*(Y(3)+Y(4))+Y(6))
SUM2=Y(5)+Y(5)
SUM2=SUM2+SUM2
SUM2=AUX2-HT*(Y(4)+SUM2+Y(6))
Z(1)=0.
AUX=Y(3)+Y(3)
AUX=AUX+AUX
Z(2)=SUM2-HT*(Y(2)+AUX+Y(4))
Z(3)=SUM1
Z(4)=SUM2
-
+
IF(NDIM-6)5,5,2
0
3
A1
C INTEGRATION LOOP
2
DO 4 I=7,NDIM,2
3
SUM1=AUX1
SUM2=AUX2
AUX1=Y(I-1)+Y(I-1)
AUX1=AUX1+AUX1
AUX1=SUM1+HT*(Y(I-2)+AUX1+Y(I))
Z(I-2)=SUM1
-
+
IF(I-NDIM)3,6,6
0
3
A2
3
AUX2=Y(I)+Y(I)
AUX2=AUX2+AUX2
AUX2=SUM2+HT*(Y(I-1)+AUX2+Y(I+1))

CONT. ON PG 3


2
4
Z(I-1)=SUM2
2
A1
5
Z(NDIM-1)=AUX1
Z(NDIM)=AUX2
RETURN
2
A2
6
Z(NDIM-1)=SUM2
Z(NDIM)=AUX1
RETURN
C END OF INTEGRATION LOOP
1
A3
7
IF(NDIM-3)12,11,8
4
A6
4
A5
0
C NDIM IS EQUAL TO 4 OR 5
1
A4
8
SUM2=1.125*HT*(Y(1)+Y(2)+Y(2)+Y(2)+Y(3)+Y(3)+Y(3)+Y(4))
SUM1=Y(2)+Y(2)
SUM1=SUM1+SUM1
SUM1=HT*(Y(1)+SUM1+Y(3))
Z(1)=0.
AUX1=Y(3)+Y(3)
AUX1=AUX1+AUX1
Z(2)=SUM2-HT*(Y(2)+AUX1+Y(4))

CONT. ON PG 4


IF(NDIM-5)10,9,9
−
+
0
9
AUX1=Y(4)+Y(4)
AUX1=AUX1+AUX1
Z(5)=SUM1+HT*(Y(3)+AUX1+Y(5))
10
Z(3)=SUM1
Z(4)=SUM2
RETURN
C NDIM IS EQUAL TO 3
3
A5
11
SUM1=HT*(1.25*Y(1)+Y(2)+Y(2)-.25*Y(3))
SUM2=Y(2)+Y(2)
SUM2=SUM2+SUM2
Z(3)=HT*(Y(1)+SUM2+Y(3))
Z(1)=0.
Z(2)=SUM1
3
A6
12
RETURN
END

PG 4 FINAL

```
SUBROUTINE DPI (IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE,NOWAT)
DIMENSION IPIC(2), ICHOSE(2), NCONF(6), NCHOSE(2)
```

```
COMMON /USER3/ARRAYN(11,3), BTRMX,     NMSEQ,     OPSMS,     SCSFL,
               TPRFL
```

```
COMMON /USERI/     APOGEE,    COMRAT,    DIAMAX, EEOWT(9),       EPME,
                   EOM1WT,    EOM1XL,    EOM1YL,    EOM1ZL,     EOM2WT,
                   EOM2XL,    EOM2YL,    EOM2ZL,        FE,     IAGNCY,
           IDEBUG, ISATOR,    MB12SN,    OPTEMP,    ORBINC,     PERIGE,
            MICRO,  RELME,   SPEC(6),     SPEC1,         T,     XCGSAI,
                     XMER,      XMEU
```

```
COMMON /BTWN/       ACSSN,     ACSWP,       ALT,      AREA,     BATCAP,
                BITRAT(2),     CLIFE,    CONVWT,         D,         DT,
                       DX,        DY,        DZ,     EOBLG,     EOBSID,
                       FC,        FF,    HARNWT,       HPT,     HTPIPE,
                     HTPT,    HTRPRB,    HTRPWR,                IBTLOC,
                    LMBOD,        NC,    OMEGS,     PASSTR,         PJ,
                       PL,     PLMIN,    POCNWT,      RADA,      RADAB,
                      RAT,        RJ,    SABOLG,     SATLG,     SATTWT,
```

```
                    SATWT,    SATXCG,    SATYCG,    SATZCG,     SA1XL,
                    SA1YL,     SA1ZL,      SIDE,    SYSLB,     THCMWT,
                THRUST(2),        TI,     TNKWT,     TPRIM,         VB,
                     VCHP,       VOL,      WATE,        WB,        WBT,
                       WT,        XJ,    XNZERO,        YJ,         ZJ
```

```
COMMON /DBCOM/DATAB(55,100),IDB(30)
```

```
COMMON /CHOSE/     COST(5,60),      ARRAY(11,60),      ICHOSO(60),
                   NCHOSO(60),      REL ( 6,60),       SKD(7,60),
                   THM(4,60)
```

```
COMMON/PRTCOM/   ACCRCY,        AM,        AN,        BF,         BS,
               CDPI(7,2),    CISTAR,      CTOT,      DDTE,         DE,
                   DRIWT,    EOBSTR,    FEEINV,    FEEOPS,       FEER,
                     GSE,      IREL,    ITRUNC,    MMDOLD,NAME(3,60),
                     OPS,    PAYINV,    PAYOUL,      PAYR,         PE,
                     PMP,       PMR,  POWER(6),        PU,    PWR(60),
                     OCP,       OCR,  ROLD(60),    SABMWT,     SATAOP,
                  SATINV,      SATR,      SEIP,      SEIR,   SKTAU(6),
```

```
                 SSREL(6),   SUBE(7),   SUBT(7),  SUBUE(7),   SUBUP(7),
                       TA,  TAU(6,6),        TB,        TC,         TE,
                       TF,     TOOLR,     TOOLU,    TOTOPS,      TRUNC,
                       TS,       TTT,VOLUME(6),   VOL(60),WEIGHT(6),
                    XLTOT,      XMEH,    XMEINV,      XMEL,      XMEVL,
                     XMEW,     XMEWT,     XVEST
```

```
DIMENSION HSRT(60),TLPTH(60),GRANH(60),XSRT(60),TLPTL(60),
          GRANL(60)
```

```
DATA ACSRT,ACSOP,COMOP,DPREQ/10.,50.,6.,4./
```

CONT. ON PG 2

```
C          INPUTS  FOR DATA PROCESSING SUBSYSTEMS - DPI
C   INPUT   CDPI    T D SOURCE  UNITS  DESCRIPTION
C   VAR.    IN.
C   GRANH   36      R Y ALL S/S         GRANULARITY HIGH RATE TABLE
C   HSRT    35      R Y ALL S/S SPS    SAMPLE RATE HIGH TABLE
C   TLPTH   34+35   R Y ALL S/S        NO OF ANGL AND DIG POINTS HIGH
C   GRANL   40      R Y ALL S/S        GRANULARITY LOW RATE TABLE
C   XSRT    39      R Y ALL S/S SPS    SAMPLE RATE LOW TABLE
```

```
C  TLPTL   37+38  R Y ALL S/S        NO OF ANGL AND DIG POINTS LOW
C  SCSFL          R    U              SPECIAL COMMAND SYNC FLAG
C  TOTCM   30T032 R    DB             TOTAL NO OF COMMANDS
C  COMTY          R    MACRO          NCONF(3) - SPEC OR GEN COMPUTER FLAG
C  TTCPL   32     R                   TIME TAG COMMAND FLAG
C  TPRFL          R    U              TELEM PROCESS FLAG
C  ACSSN          R    SC             SUM OF ACS  SENSOR
C  COMRT          R    COMM           COMMAND RATE
```

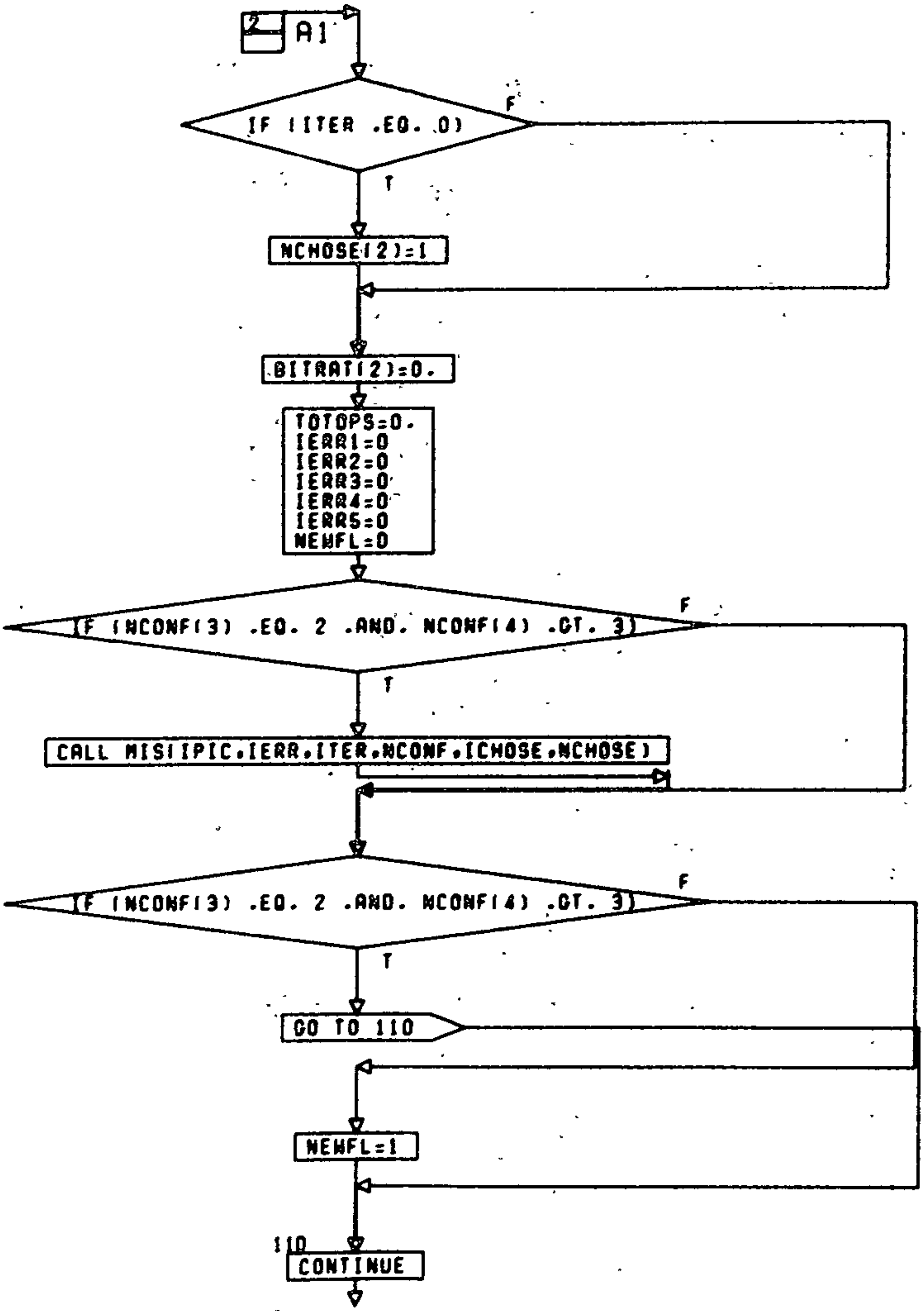
```
C  DPSMS          R    U        SEC-1  MISSION OPS
C  MISPD          I    U               MISSION DATA PROC. FLAG
C            ERROR FLAGS
C            IERR = 1     MUX IS REQUIRED
C            IERR = 10    WORD LENGTH GREATER THAN 256
C            IERR = 100   BIT RATE IS TOO LARGE
C            IERR = 1000 SPECIAL COMMAND SYNC FLAG IS NOT EQUAL TO ZERO
C            IERR = 10000   J1 .GE. J1E
```

```
DO 1 I=1,7
DO 1 J=1,2
1 CDPI(I,J)=0.0
```

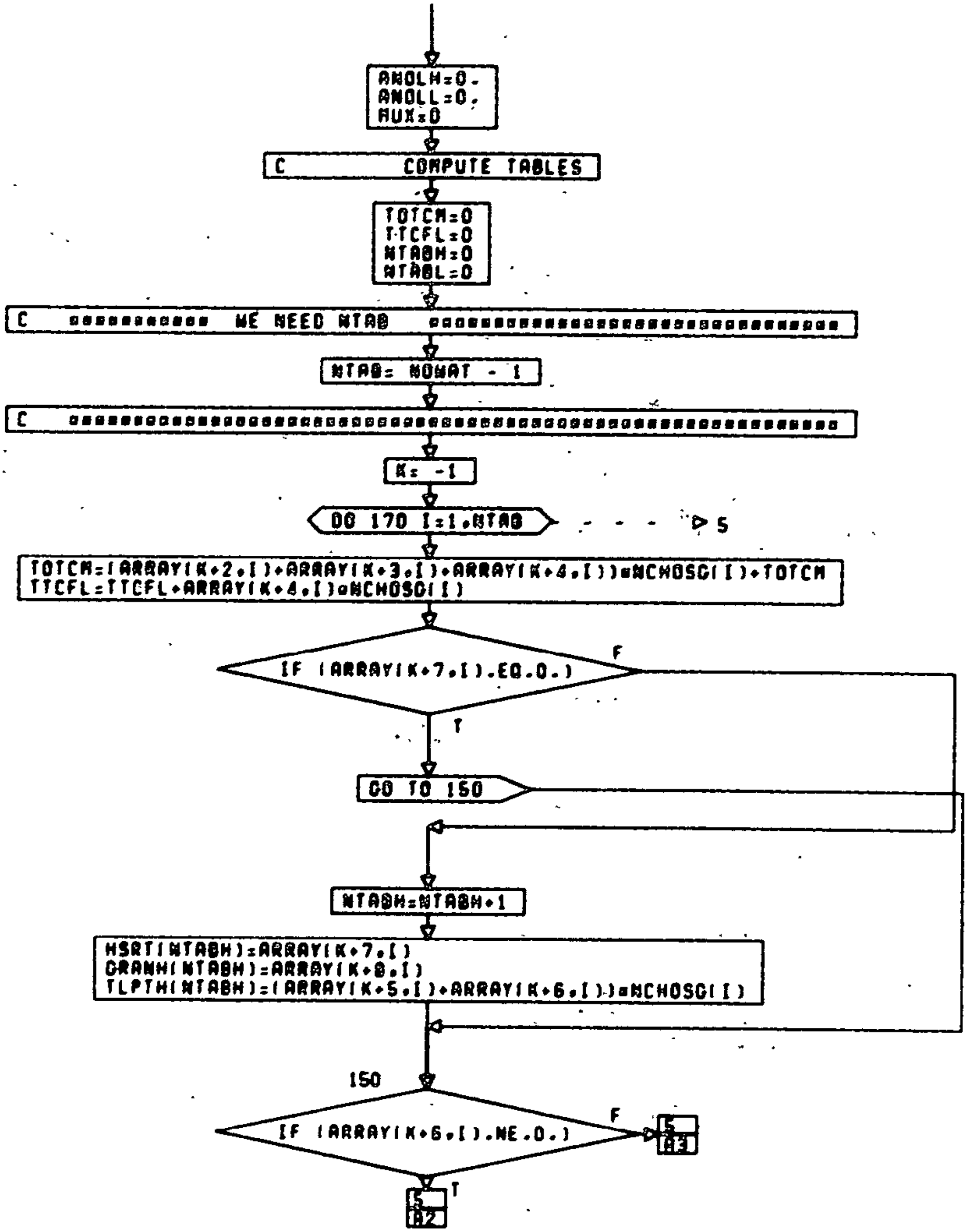
```
IERR=0
ICHOSE(1)=0
ICHOSE(2)=0
```

```
IF (ITER .EQ. 0)   F → 3 / B1
                   T ↓
NCHOSE(1)=1
```

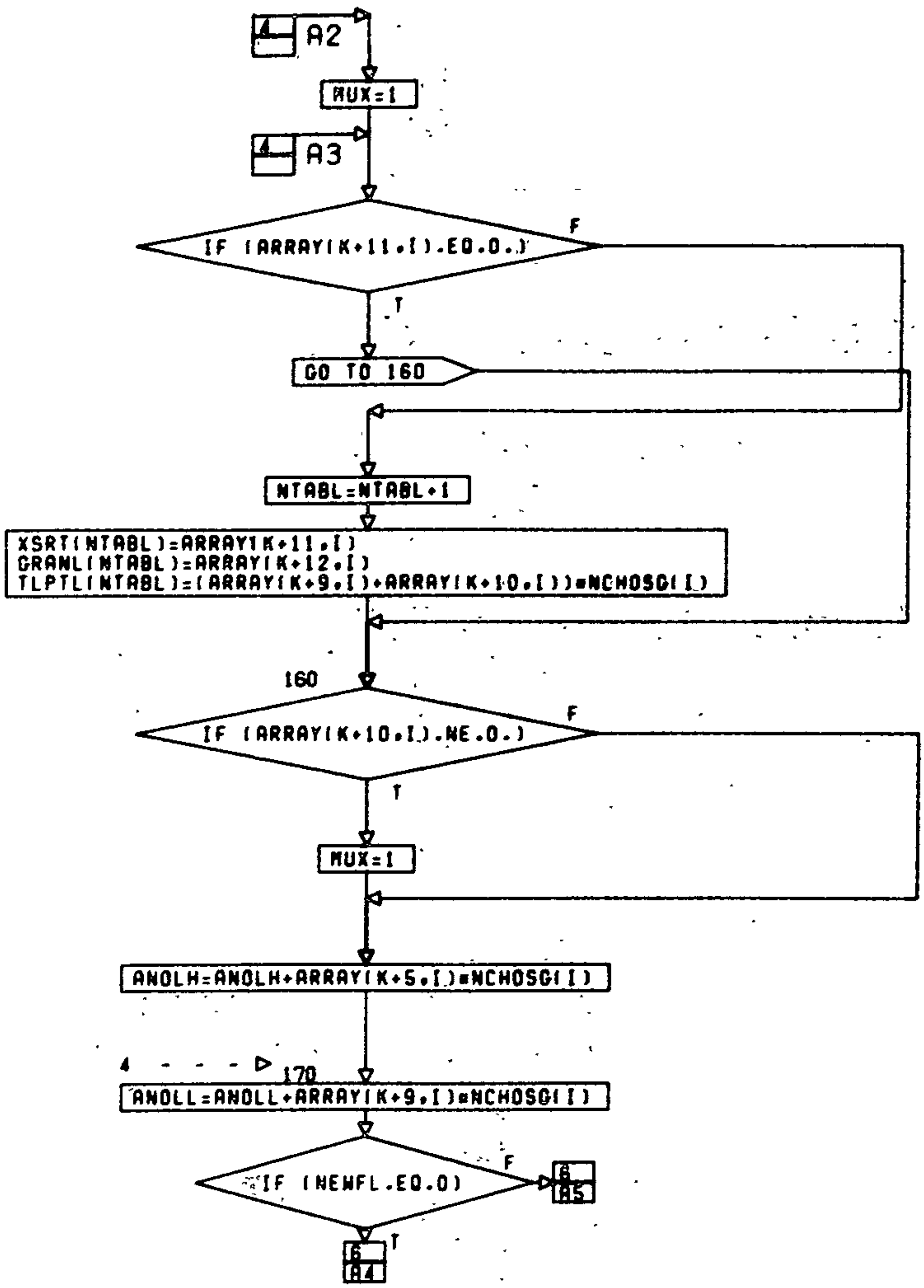
CONT. ON PG 3


2
A1
IF (ITER .EQ. 0)
F
T
NCHOSE(2)=1
BITRAT(2)=0.
TOTOPS=0.
IERR1=0
IERR2=0
IERR3=0
IERR4=0
IERR5=0
NEWFL=0
IF (NCONF(3) .EQ. 2 .AND. NCONF(4) .GT. 3)
F
T
CALL MISI(PIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)
IF (NCONF(3) .EQ. 2 .AND. NCONF(4) .GT. 3)
F
T
GO TO 110
NEWFL=1
110
CONTINUE

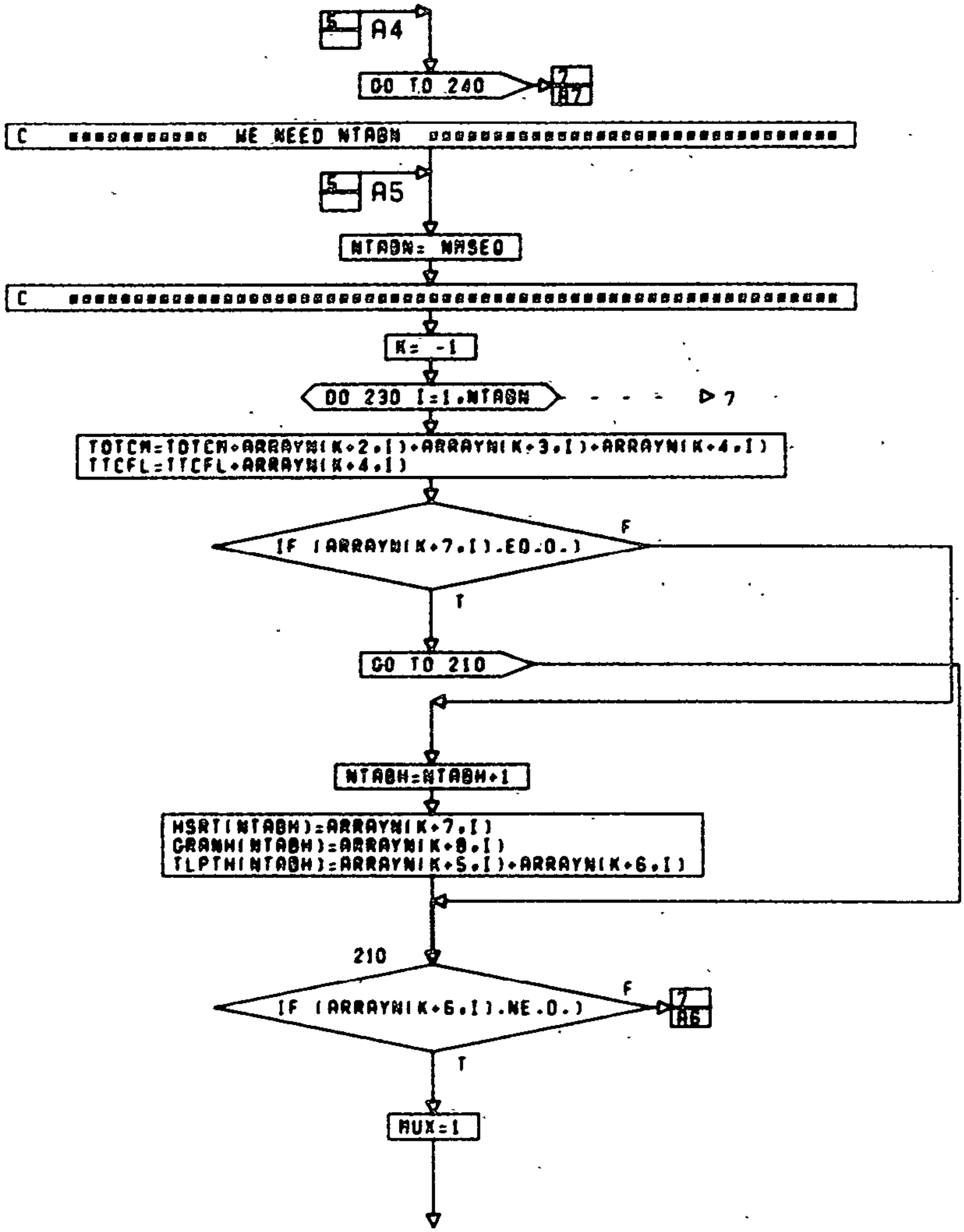
CONT. ON PG 4


ANOLH=0.
ANOLL=0.
AUX=0
C COMPUTE TABLES
TOTCM=0
TTCFL=0
NTABH=0
NTABL=0
C ************ WE NEED NTAB ********************************
NTAB= NOWAT - 1
C **
K= -1
DO 170 I=1,NTAB
5
TOTCM=(ARRAY(K+2,I)+ARRAY(K+3,I)+ARRAY(K+4,I))*NCHOSO(I)+TOTCM
TTCFL=TTCFL+ARRAY(K+4,I)*NCHOSO(I)
IF (ARRAY(K+7,I).EQ.0.)
F
T
GO TO 150
NTABH=NTABH+1
HSRT(NTABH)=ARRAY(K+7,I)
GRANH(NTABH)=ARRAY(K+8,I)
TLPTH(NTABH)=(ARRAY(K+5,I)+ARRAY(K+6,I))*NCHOSO(I)
150
IF (ARRAY(K+6,I).NE.0.)
F
5
A3
T
5
A2

CONT. ON PG 5

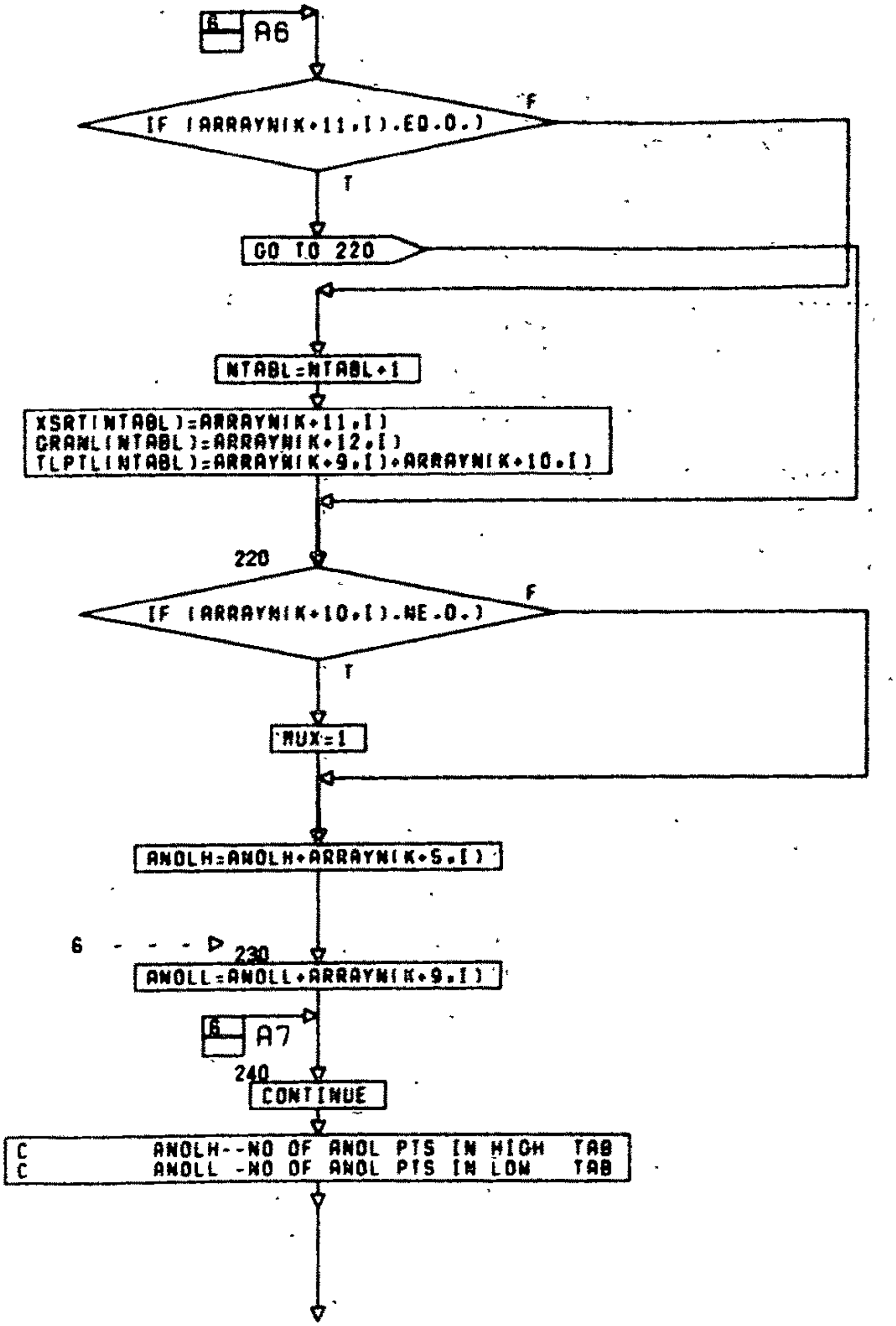

4 A2
MUX=1
4 A3
IF (ARRAY(K+11,I).EQ.0.)
F
T
GO TO 160
NTABL=NTABL+1
XSRT(NTABL)=ARRAY(K+11,I)
GRANL(NTABL)=ARRAY(K+12,I)
TLPTL(NTABL)=(ARRAY(K+9,I)+ARRAY(K+10,I))*NCHOSG(I)
160
IF (ARRAY(K+10,I).NE.0.)
F
T
MUX=1
ANOLH=ANOLH+ARRAY(K+5,I)*NCHOSG(I)
4
170
ANOLL=ANOLL+ARRAY(K+9,I)*NCHOSG(I)
IF (NEWFL.EQ.0)
F
6 A5
T
6 A4

CONT. ON PG 6

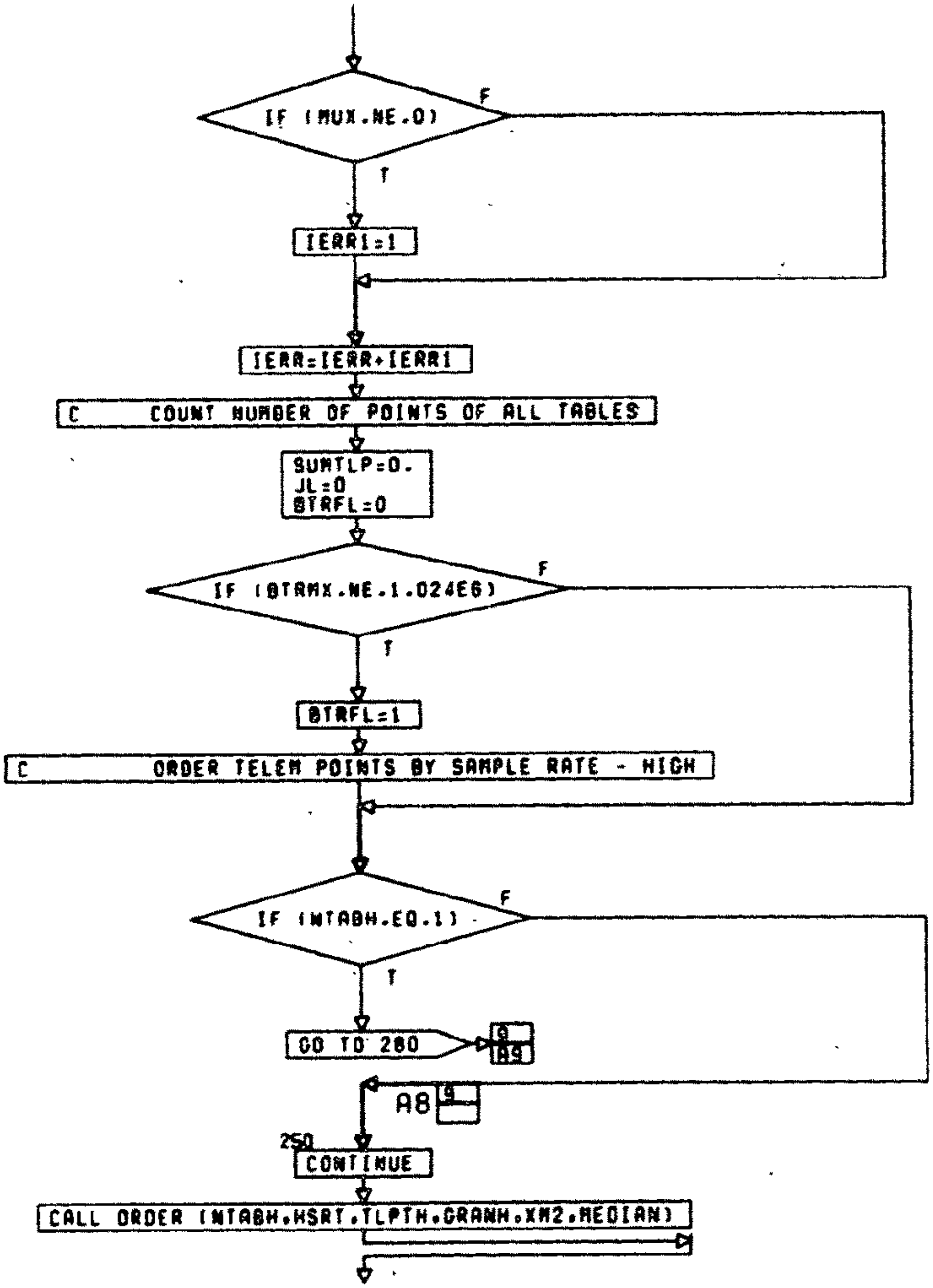


5
A4
DO TO 240
7
A7
C ************ WE NEED NTABN ********************************
5
A5
NTABN= NMSEQ
C **
K= -1
DO 230 I=1,NTABN
7
TOTCM=TOTCM+ARRAYN(K+2,I)+ARRAYN(K+3,I)+ARRAYN(K+4,I)
TTCFL=TTCFL+ARRAYN(K+4,I)
IF (ARRAYN(K+7,I).EQ.0.)
F
T
GO TO 210
NTABH=NTABH+1
HSRT(NTABH)=ARRAYN(K+7,I)
GRANH(NTABH)=ARRAYN(K+8,I)
TLPTH(NTABH)=ARRAYN(K+5,I)+ARRAYN(K+6,I)
210
IF (ARRAYN(K+6,I).NE.0.)
F
7
A6
T
MUX=1

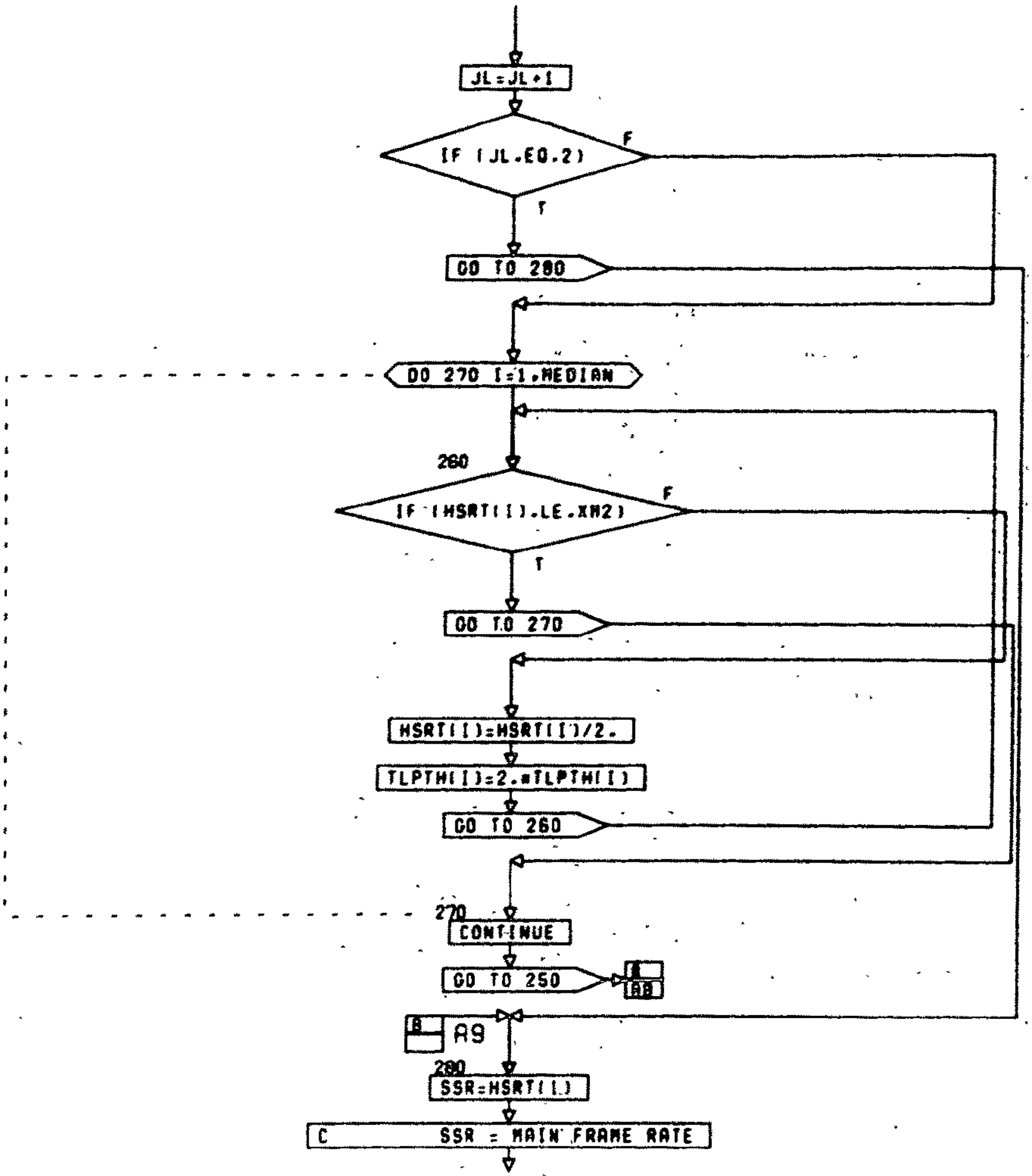
CONT. ON PG 7


A6
IF (ARRAYN(K+11,I).EQ.0.)
F
T
GO TO 220
NTABL=NTABL+1
XSRT(NTABL)=ARRAYN(K+11,I)
GRANL(NTABL)=ARRAYN(K+12,I)
TLPTL(NTABL)=ARRAYN(K+9,I)+ARRAYN(K+10,I)
220
IF (ARRAYN(K+10,I).NE.0.)
F
T
MUX=1
ANOLH=ANOLH+ARRAYN(K+5,I)
6
230
ANOLL=ANOLL+ARRAYN(K+9,I)
A7
240
CONTINUE
C ANOLH--NO OF ANOL PTS IN HIGH TAB
C ANOLL -NO OF ANOL PTS IN LOW TAB

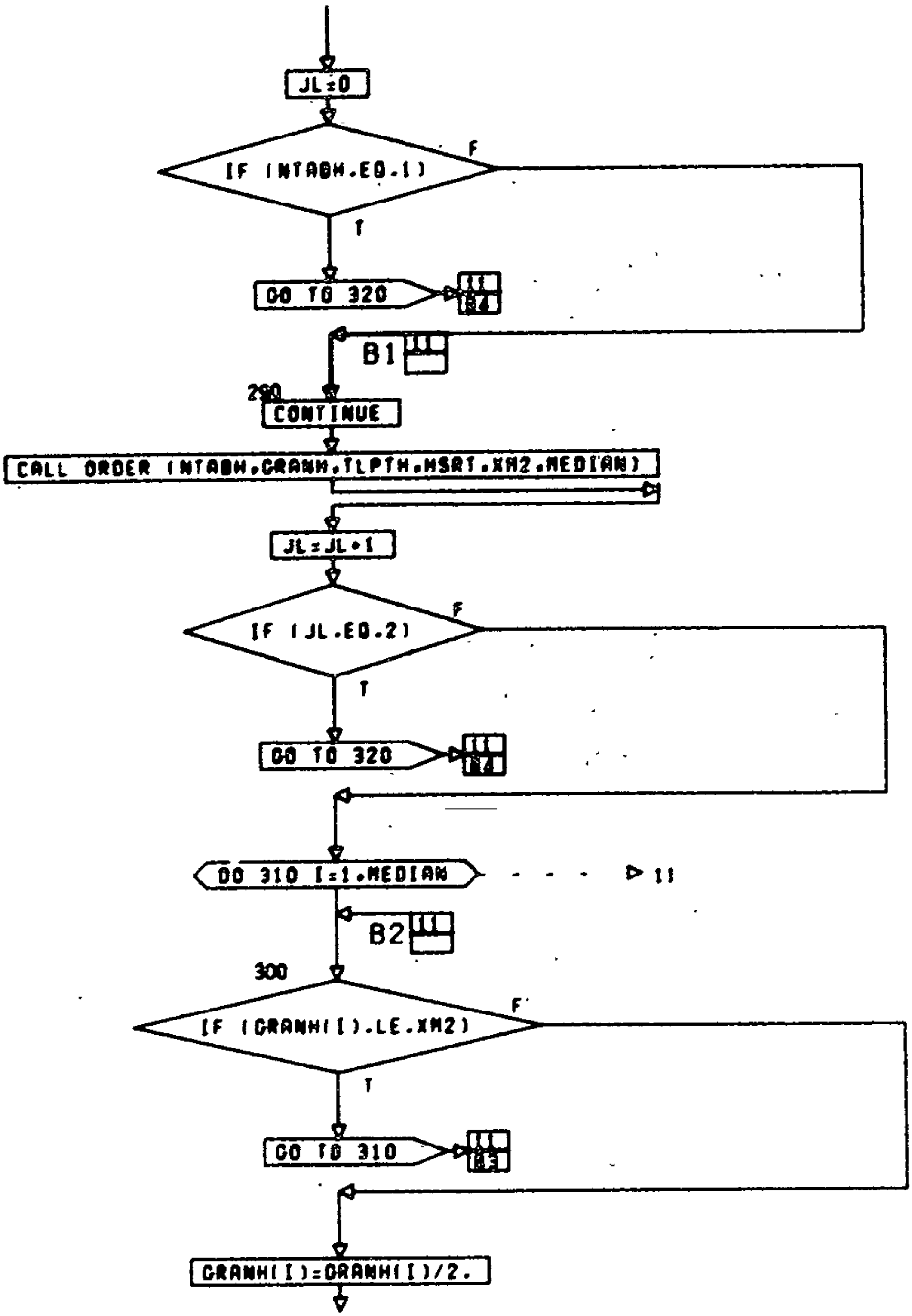
CONT. ON PG 8


IF (MUX.NE.0)
F
T
IERR1=1
IERR=IERR+IERR1
C COUNT NUMBER OF POINTS OF ALL TABLES
SUMTLP=0.
JL=0
BTRFL=0
IF (BTRMX.NE.1.024E6)
F
T
BTRFL=1
C ORDER TELEM POINTS BY SAMPLE RATE - HIGH
IF (NTABH.EQ.1)
F
T
GO TO 280
9
A9
A8
9
250
CONTINUE
CALL ORDER (NTABH,HSRT,TLPTH,DRANH,XM2,MEDIAN)

CONT. ON PG 9


JL=JL+1
IF (JL.EQ.2)
F
T
GO TO 280
DO 270 I=1,MEDIAN
260
IF (HSRT(I).LE.XM2)
F
T
GO TO 270
HSRT(I)=HSRT(I)/2.
TLPTH(I)=2.*TLPTH(I)
GO TO 260
270
CONTINUE
GO TO 250
A8
A9
280
SSR=HSRT(I)
C SSR = MAIN FRAME RATE

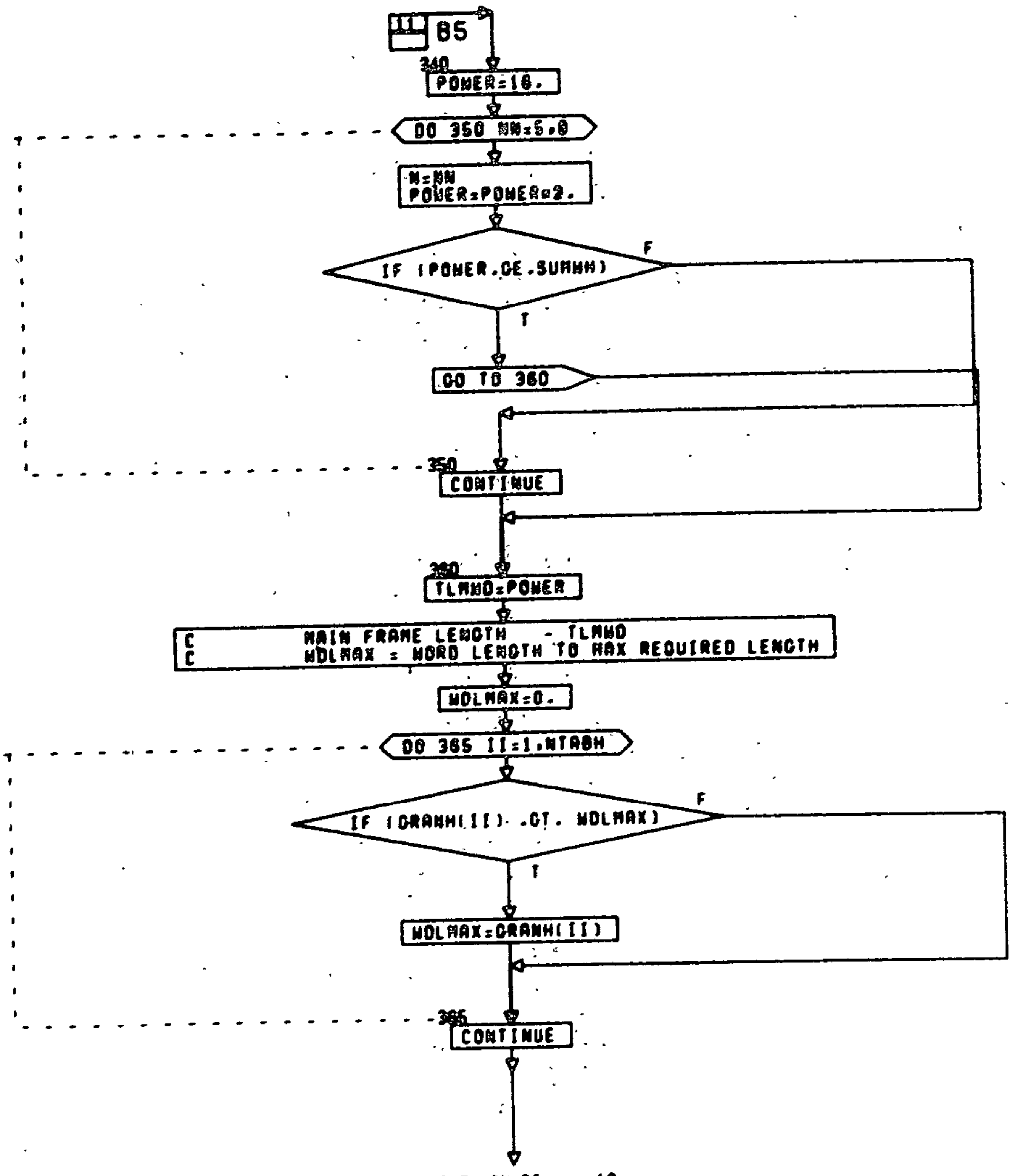
CONT. ON PG 10


JL=0
IF (NTABH.EQ.1)
F
T
GO TO 320
B1
290
CONTINUE
CALL ORDER (NTABH,GRANH,TLPTH,HSRT,XM2,MEDIAN)
JL=JL+1
IF (JL.EQ.2)
F
T
GO TO 320
DO 310 I=1,MEDIAN
B2
300
IF (GRANH(I).LE.XM2)
F
T
GO TO 310
GRANH(I)=GRANH(I)/2.

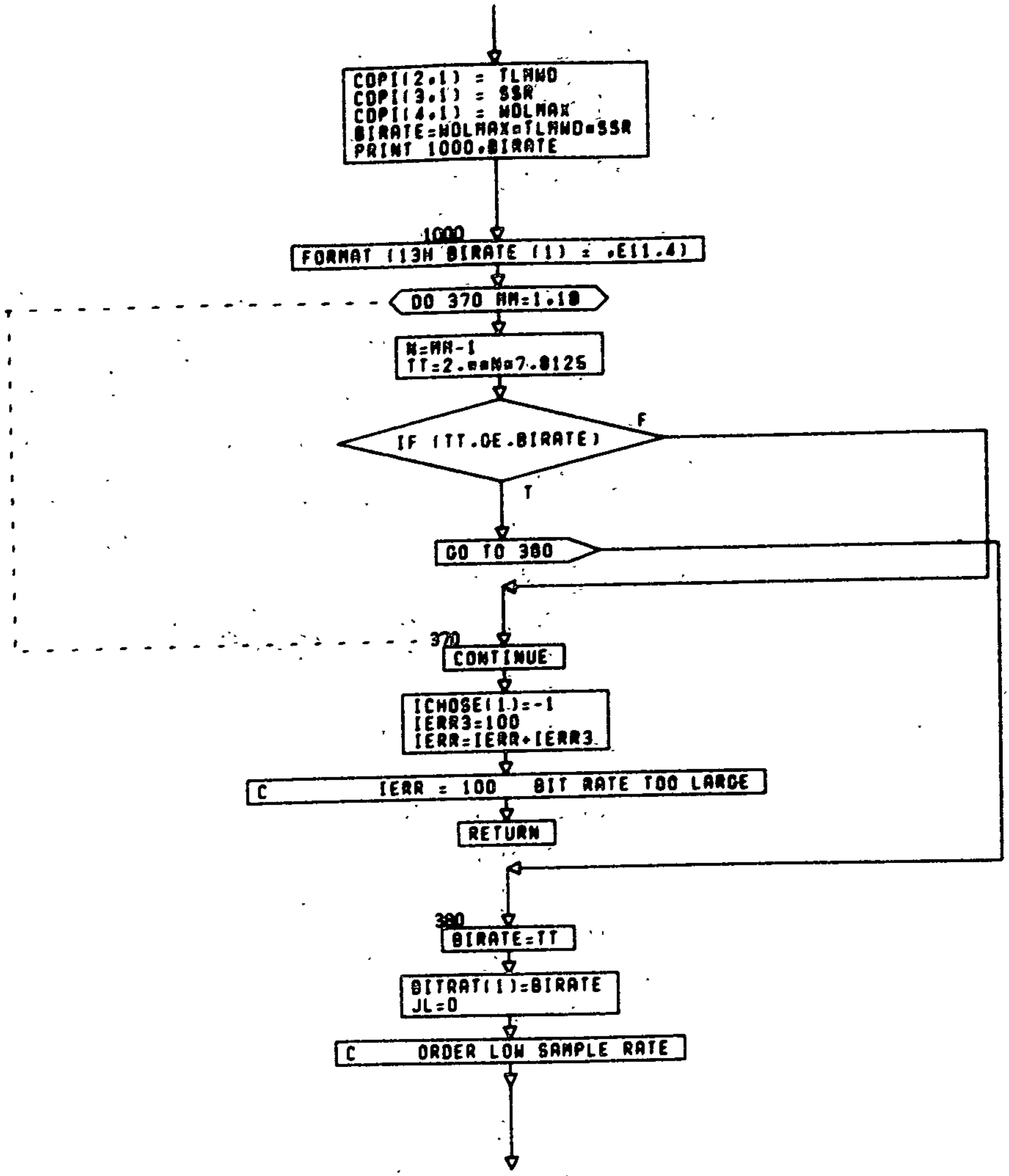
CONT. ON PG 11


TLPTH(I)=2.*TLPTH(I)
GO TO 300
10
12
10
B3
10
310
CONTINUE
GO TO 290
10
B4
10
10
320
SUMWH=0
DO 330 I=1,NTABH
330
SUMWH=SUMWH+TLPTH(I)
C SUMWH = NUMBER OF WORDS
SUMWH=SUMWH*1.2
IF (SUMWH.LE.256.)
F
T
GO TO 340
12
ICHOSE(1)=-1
IERR2=10
IERR=IERR+IERR2
RETURN

CONT. ON PG 12

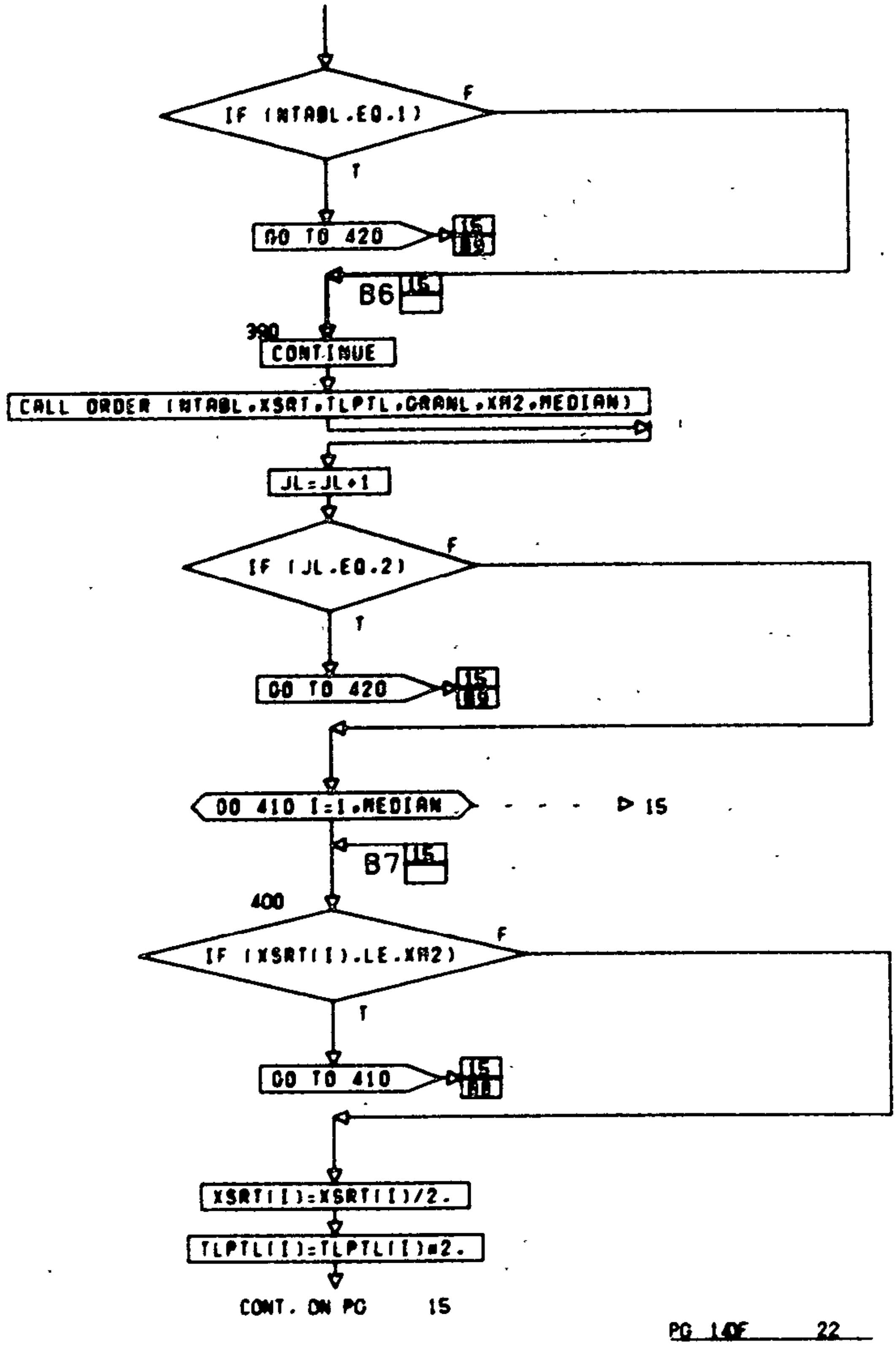

B5
340
POWER=16.
DO 360 NN=5,8
N=NN
POWER=POWER*2.
IF (POWER.GE.SUMMW)
F
T
GO TO 360
350
CONTINUE
360
TLMWD=POWER
C MAIN FRAME LENGTH - TLMWD
C WDLMAX = WORD LENGTH TO MAX REQUIRED LENGTH
WDLMAX=0.
DO 365 II=1,NTABW
IF (GRANW(II) .GT. WDLMAX)
F
T
WDLMAX=GRANW(II)
365
CONTINUE

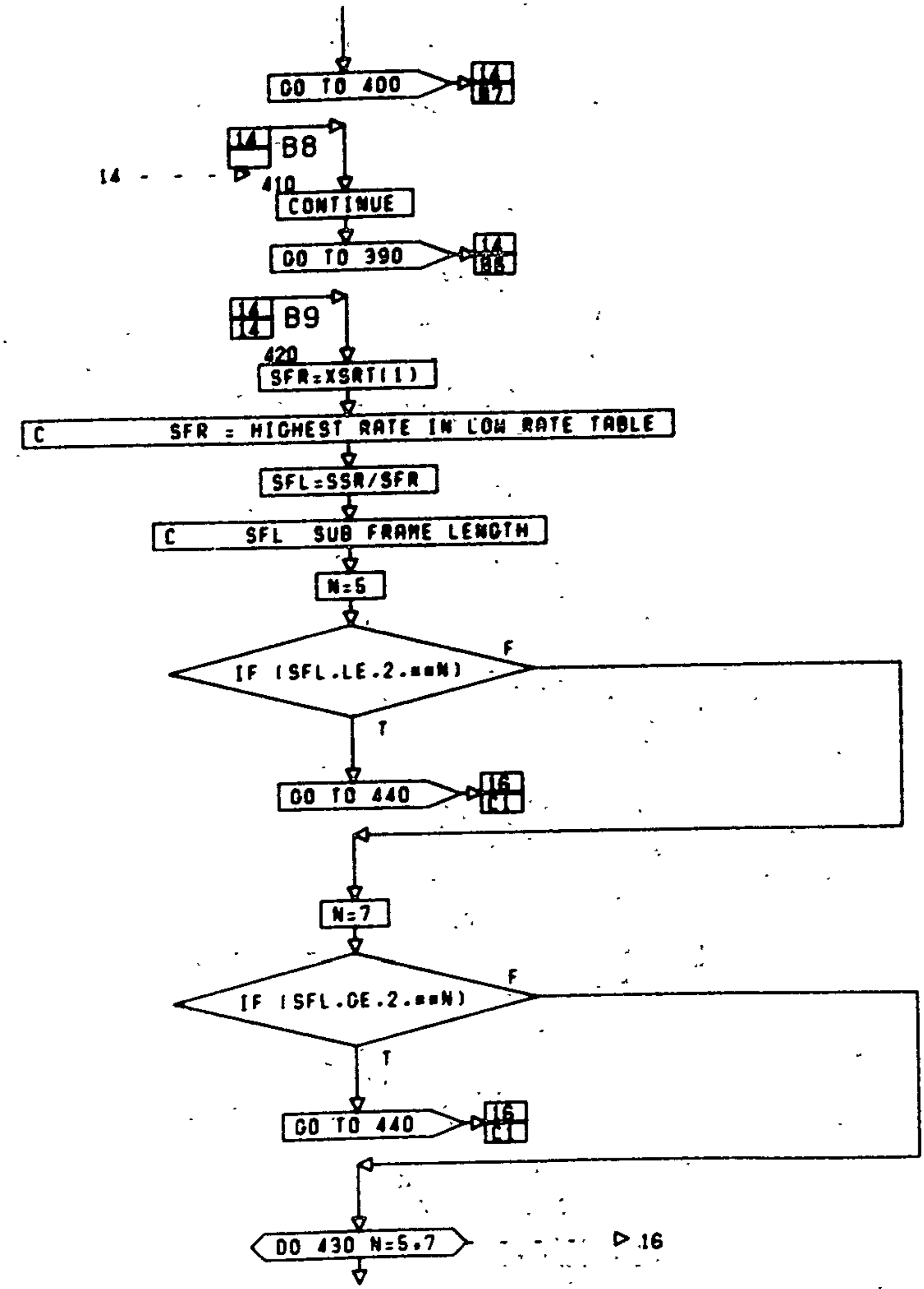
CONT. ON PG 13



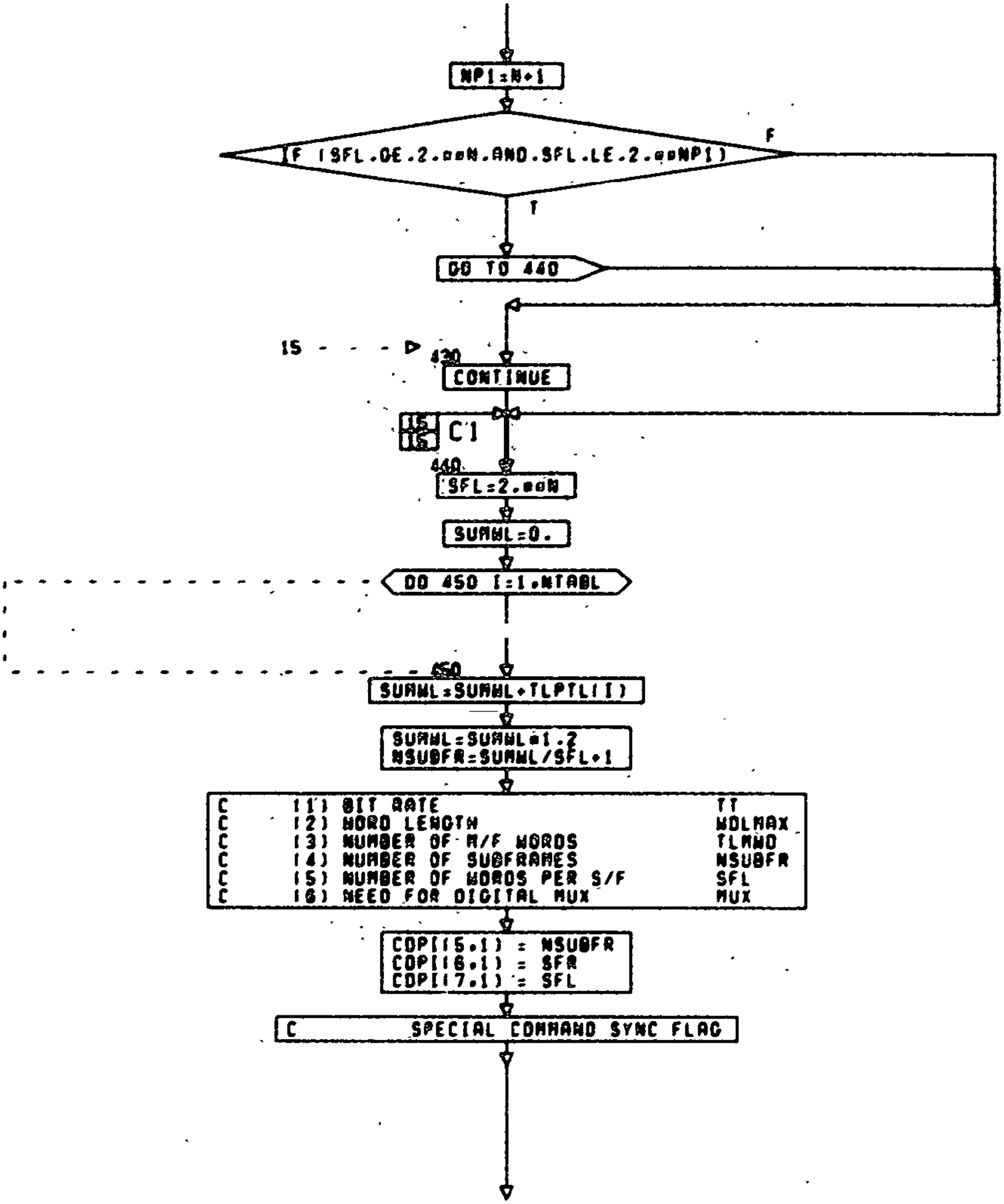
CONT. ON PG 14

PG 13F 22

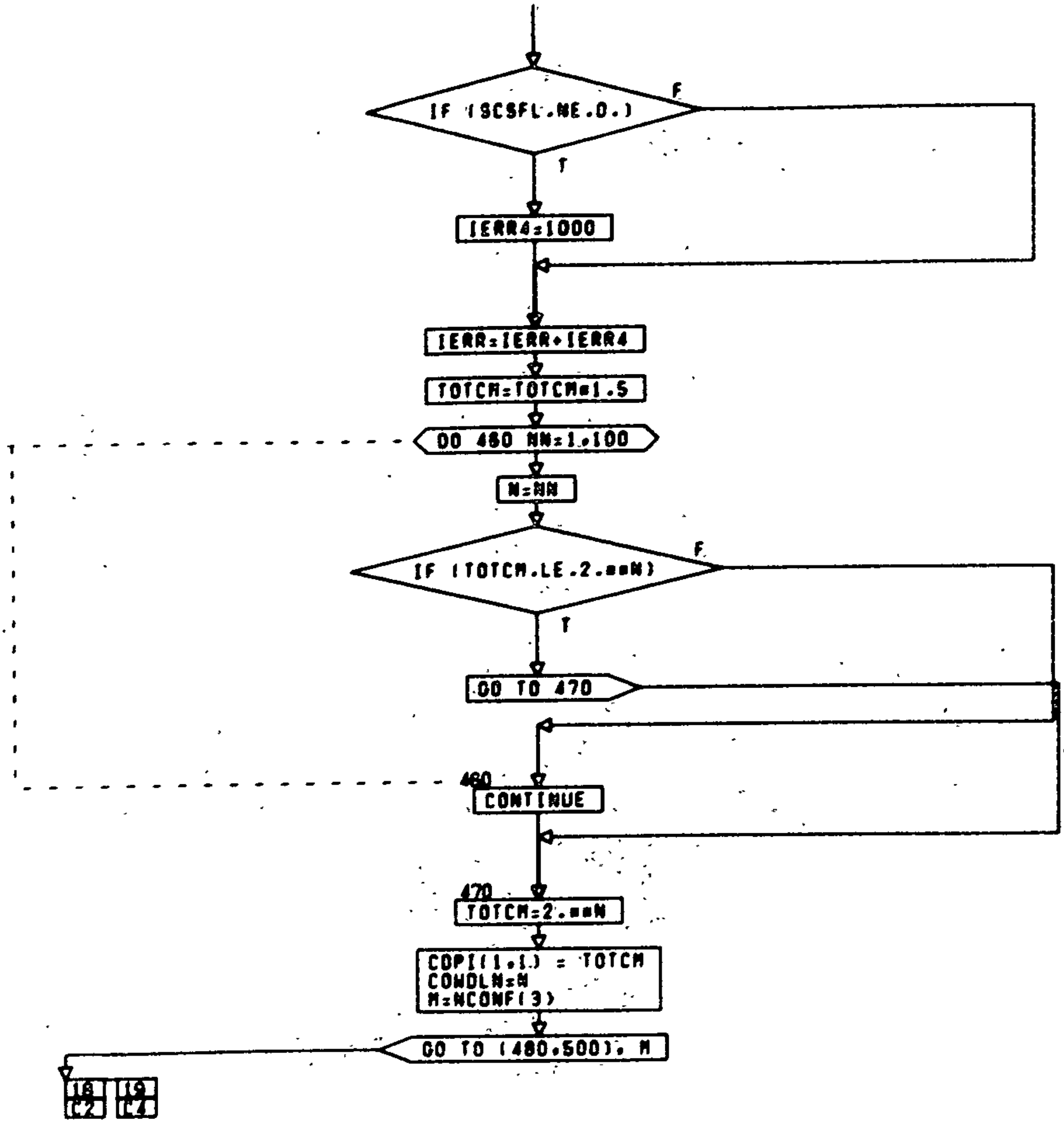

IF (NTABL.EQ.1)
F
T
GO TO 420
15
B9
B6
15
390
CONTINUE
CALL ORDER (NTABL,XSRT,TLPTL,GRANL,XM2,MEDIAN)
JL=JL+1
IF (JL.EQ.2)
F
T
GO TO 420
15
B9
DO 410 I=1,MEDIAN
15
B7
15
400
IF (XSRT(I).LE.XM2)
F
T
GO TO 410
15
B8
XSRT(I)=XSRT(I)/2.
TLPTL(I)=TLPTL(I)*2.
CONT. ON PG 15
PG 14OF 22


GO TO 400
14
B7
14
B8
14
410
CONTINUE
GO TO 390
14
B8
14
14
B9
420
SFR=XSRT(1)
C SFR = HIGHEST RATE IN LOW RATE TABLE
SFL=SSR/SFR
C SFL SUB FRAME LENGTH
N=5
IF (SFL.LE.2.**N)
F
T
GO TO 440
16
C1
N=7
IF (SFL.GE.2.**N)
F
T
GO TO 440
16
C1
DO 430 N=5,7
16

CONT. ON PG 16

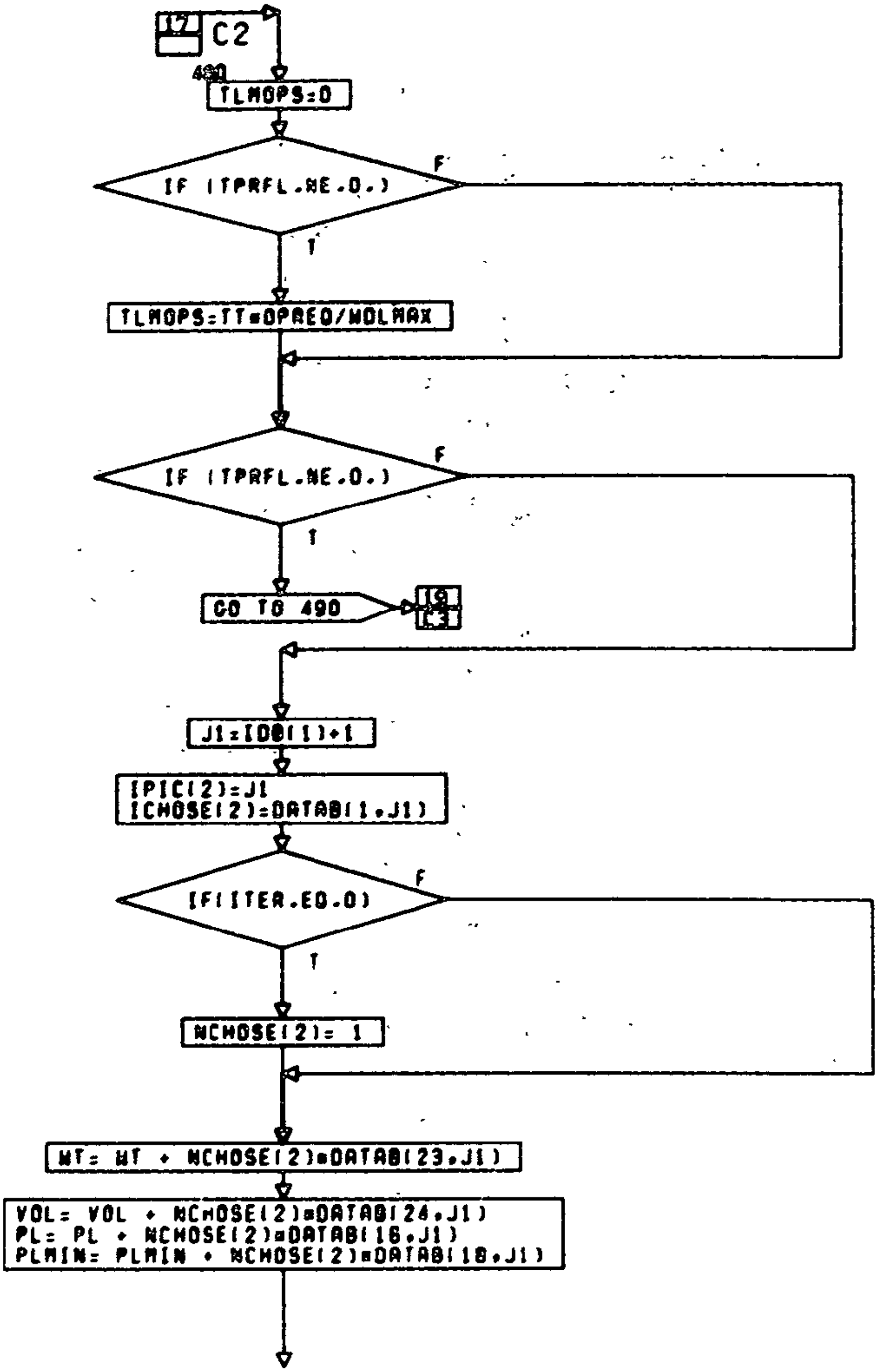

NP1=N+1
IF (SFL.GE.2.**N.AND.SFL.LE.2.**NP1)
F
T
GO TO 440
15
430
CONTINUE
15
16
C1
440
SFL=2.**N
SUMWL=0.
DO 450 I=1,NTABL
450
SUMWL=SUMWL+TLPTL(I)
SUMWL=SUMWL*1.2
NSUBFR=SUMWL/SFL+1
C (1) BIT RATE TT
C (2) WORD LENGTH WDLMAX
C (3) NUMBER OF M/F WORDS TLMWD
C (4) NUMBER OF SUBFRAMES NSUBFR
C (5) NUMBER OF WORDS PER S/F SFL
C (6) NEED FOR DIGITAL MUX MUX
COP(15,1) = NSUBFR
COP(16,1) = SFR
COP(17,1) = SFL
C SPECIAL COMMAND SYNC FLAG

CONT. ON PG. 17

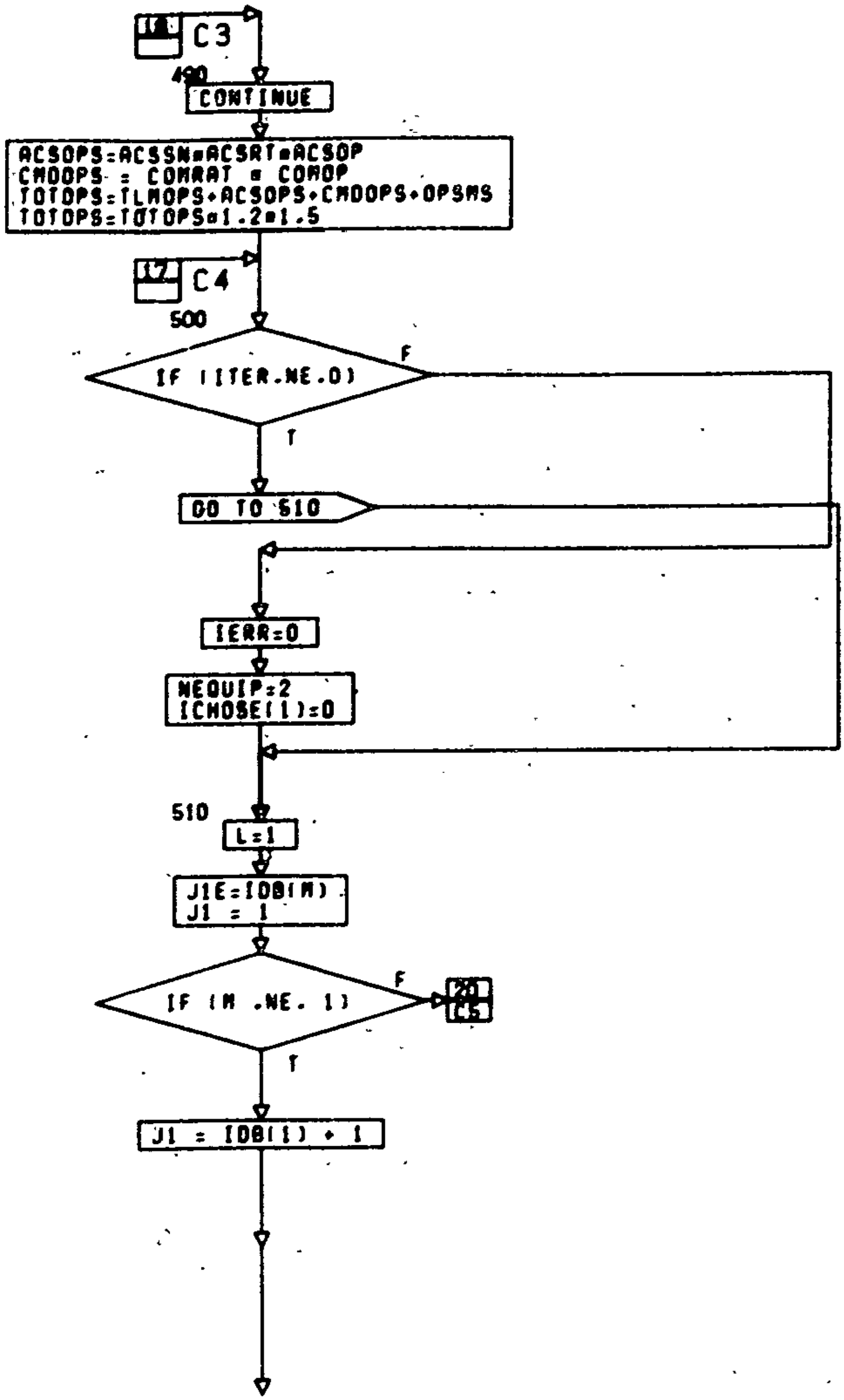


CONT. ON PG 18

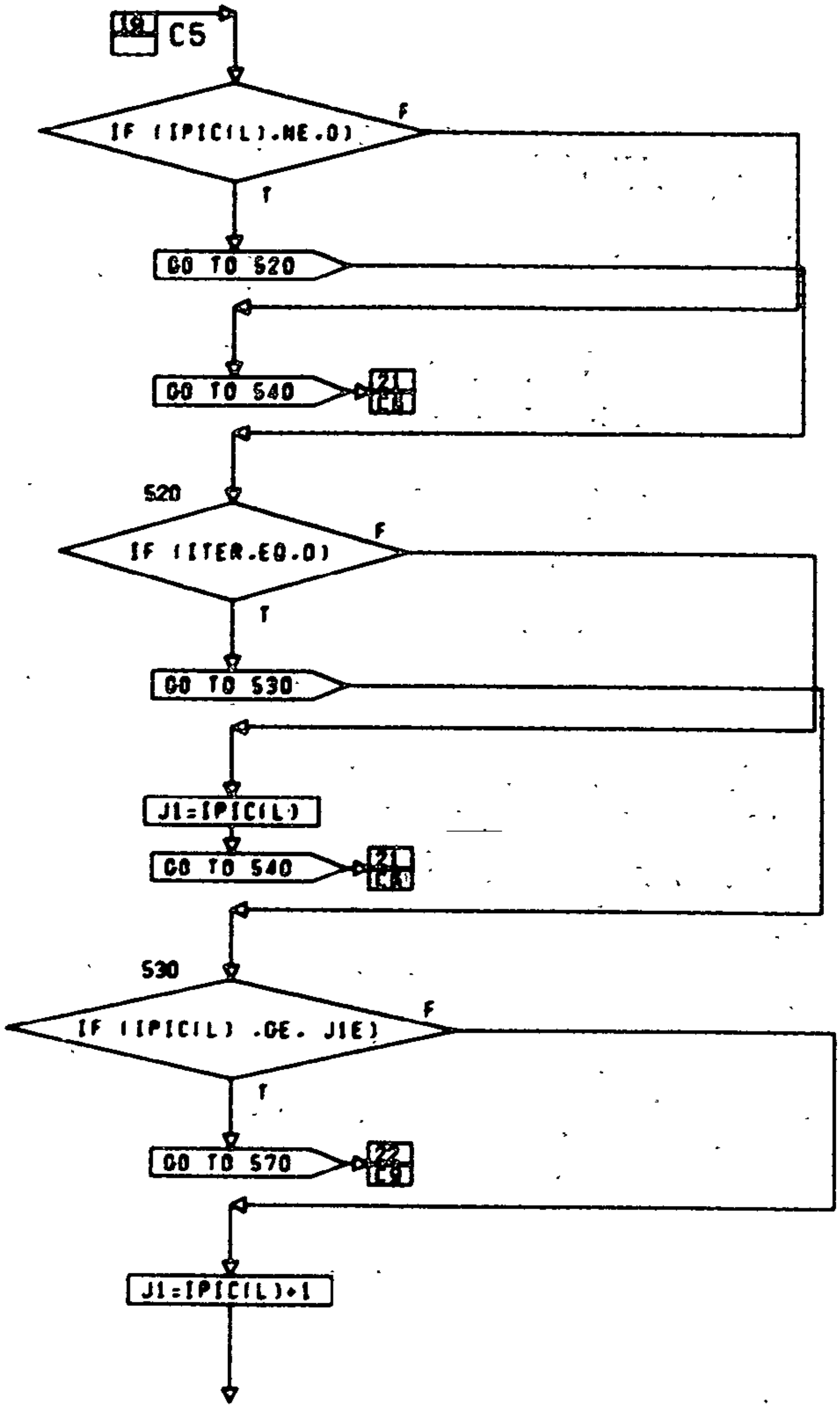
PG 17BF 22


17
C2
490
TLMOPS=0
IF (TPRFL.NE.0.)
F
T
TLMOPS=TT*OPREQ/WOLMAX
IF (TPRFL.NE.0.)
F
T
GO TO 490
19
C3
J1=IDB(1)+1
IPIC(2)=J1
ICHOSE(2)=DATAB(1,J1)
IF(ITER.EQ.0)
F
T
NCHOSE(2)= 1
WT= WT + NCHOSE(2)*DATAB(23,J1)
VOL= VOL + NCHOSE(2)*DATAB(24,J1)
PL= PL + NCHOSE(2)*DATAB(16,J1)
PLMIN= PLMIN + NCHOSE(2)*DATAB(18,J1)

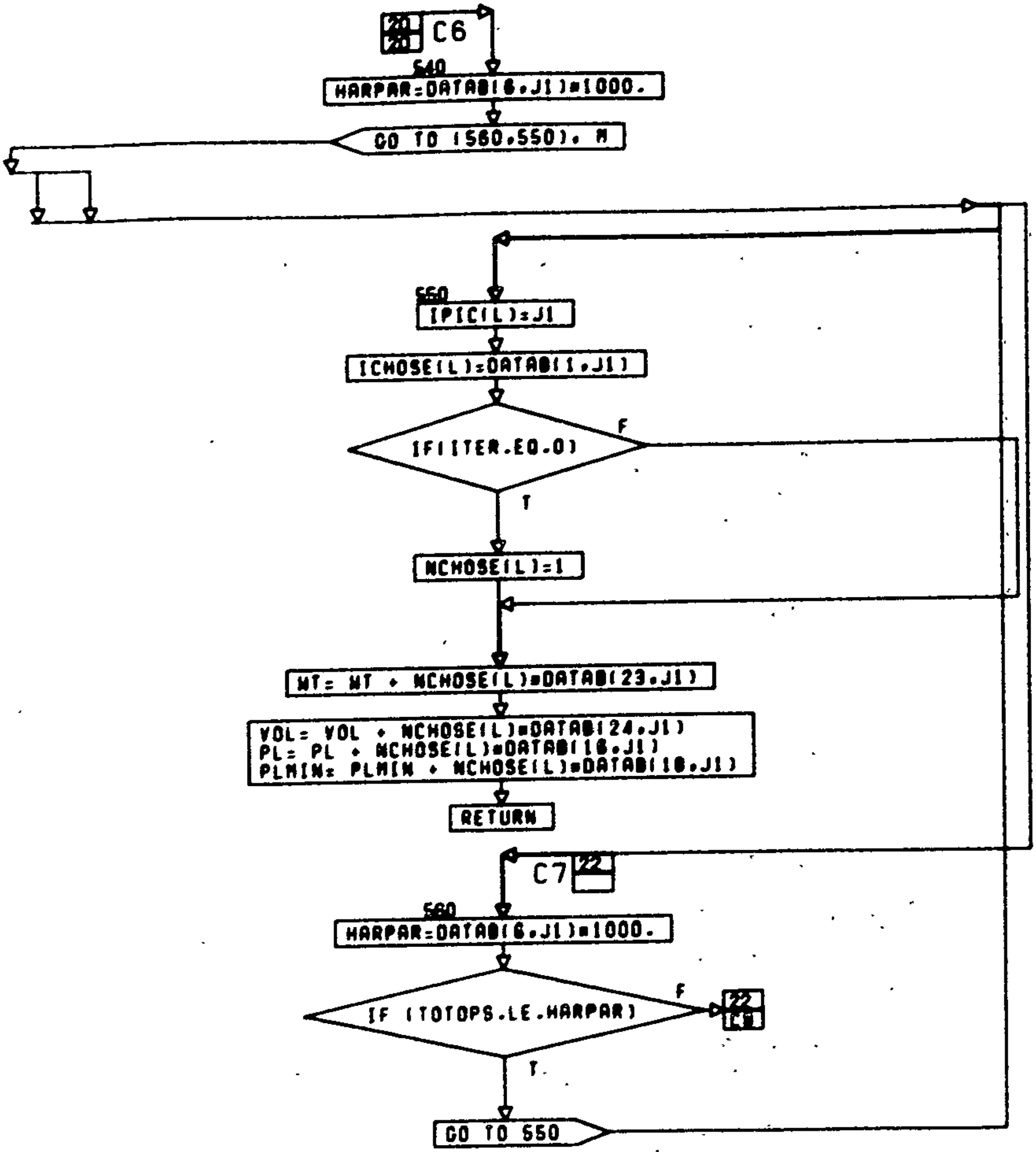
CONT. ON PG : 19


C3
490
CONTINUE
ACSOPS=ACSSN*ACSRT*ACSOP
CMDOPS = COMRAT * COMOP
TOTOPS=TLMOPS+ACSOPS+CMDOPS+OPSMS
TOTOPS=TOTOPS*1.2*1.5
17
C4
500
IF (ITER.NE.0)
F
T
GO TO 510
IERR=0
NEQUIP=2
ICHOSE(1)=0
510
L=1
J1E=IDB(M)
J1 = 1
IF (M .NE. 1)
F
20
C5
T
J1 = IDB(1) + 1

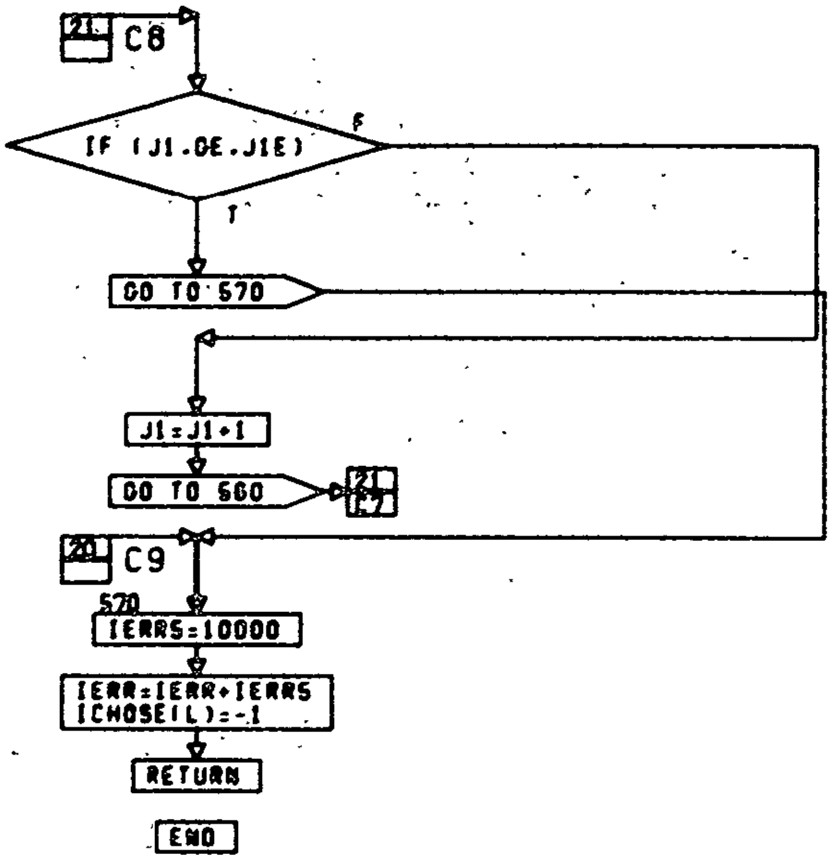
CONT. ON PG 20


C5
IF (IPIC(L).NE.0)
F
T
GO TO 520
GO TO 540
520
IF (ITER.EQ.0)
GO TO 530
J1=IPIC(L)
GO TO 540
530
IF (IPIC(L) .GE. J1E)
GO TO 570
J1=IPIC(L)+1

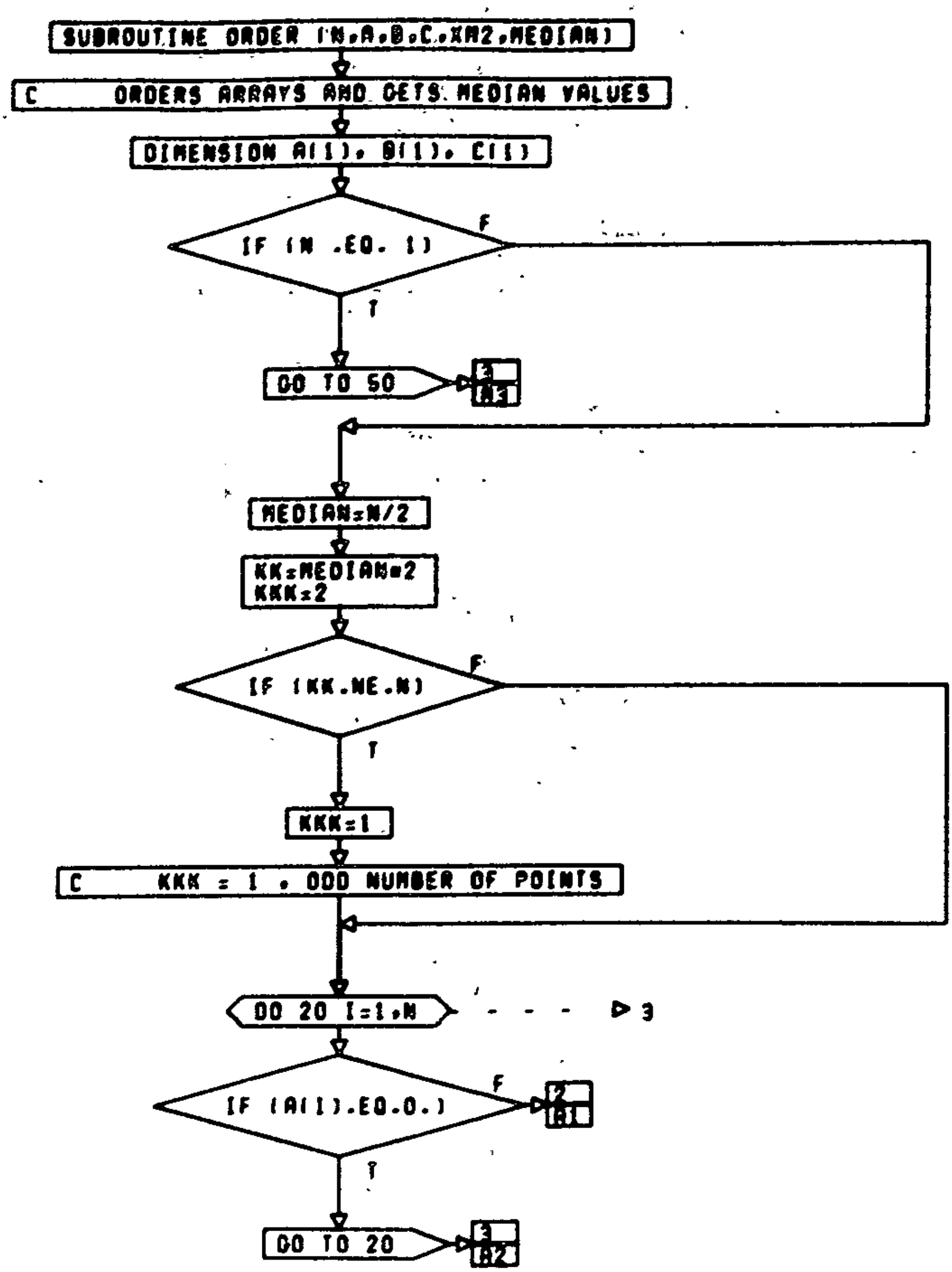
CONT. ON PG 21


C6
540
HARPAR=DATAB(6,J1)*1000.
GO TO (560,550), M
560
IPIC(L)=J1
ICHOSE(L)=DATAB(1,J1)
IF(ITER.EQ.0)
F
T
NCHOSE(L)=1
WT= WT + NCHOSE(L)*DATAB(23,J1)
VOL= VOL + NCHOSE(L)*DATAB(24,J1)
PL= PL + NCHOSE(L)*DATAB(18,J1)
PLMIN= PLMIN + NCHOSE(L)*DATAB(18,J1)
RETURN
C7
22
560
HARPAR=DATAB(6,J1)*1000.
IF (TOTOPS.LE.HARPAR)
F
T
22
GO TO 550

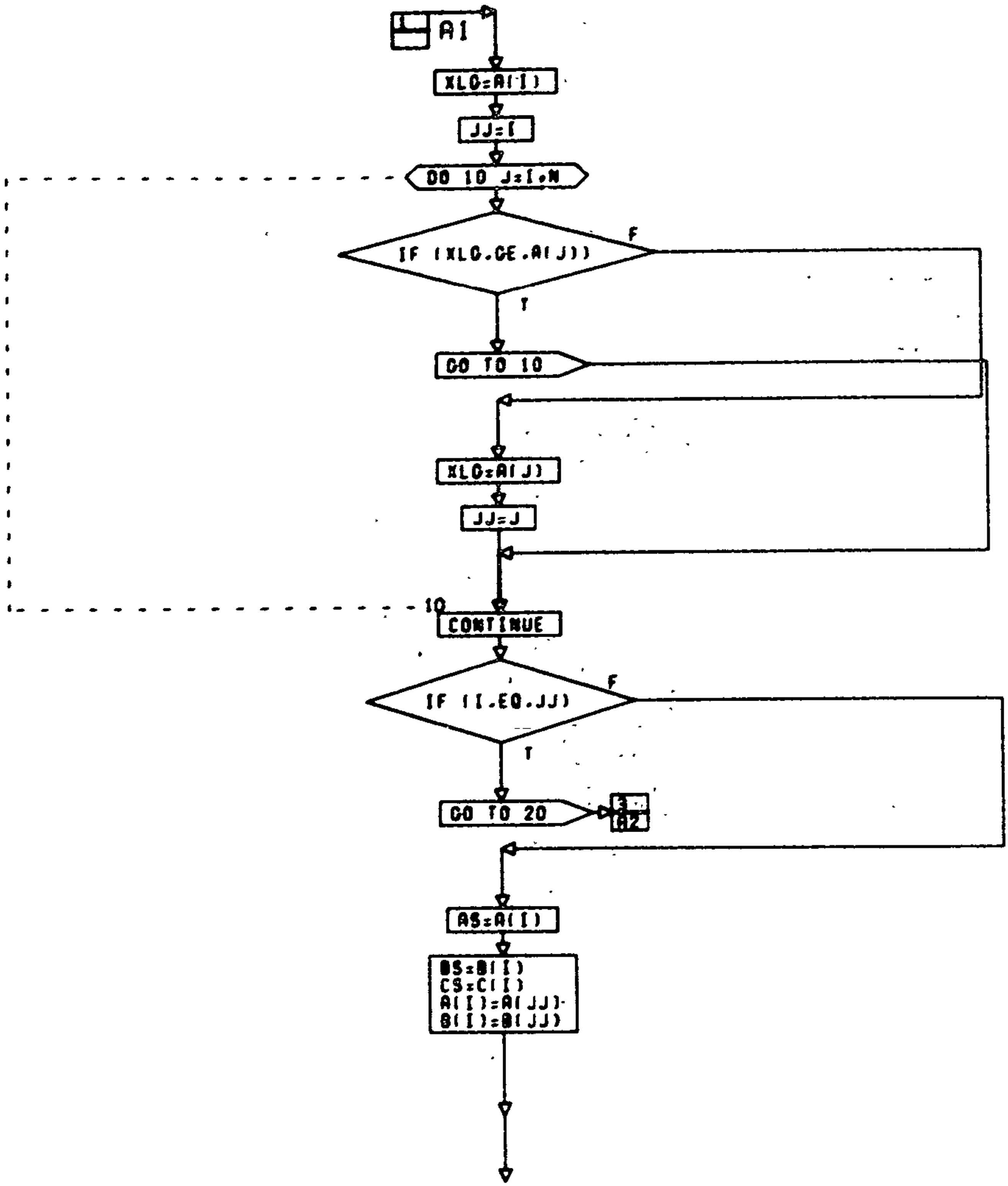
CONT. ON PG 22


21
C8
IF (J1.GE.J1E)
F
T
GO TO 570
J1=J1+1
GO TO 560
21
C7
20
C9
570
IERRS=10000
IERR=IERR+IERRS
ICHOSE(L)=-1
RETURN
END

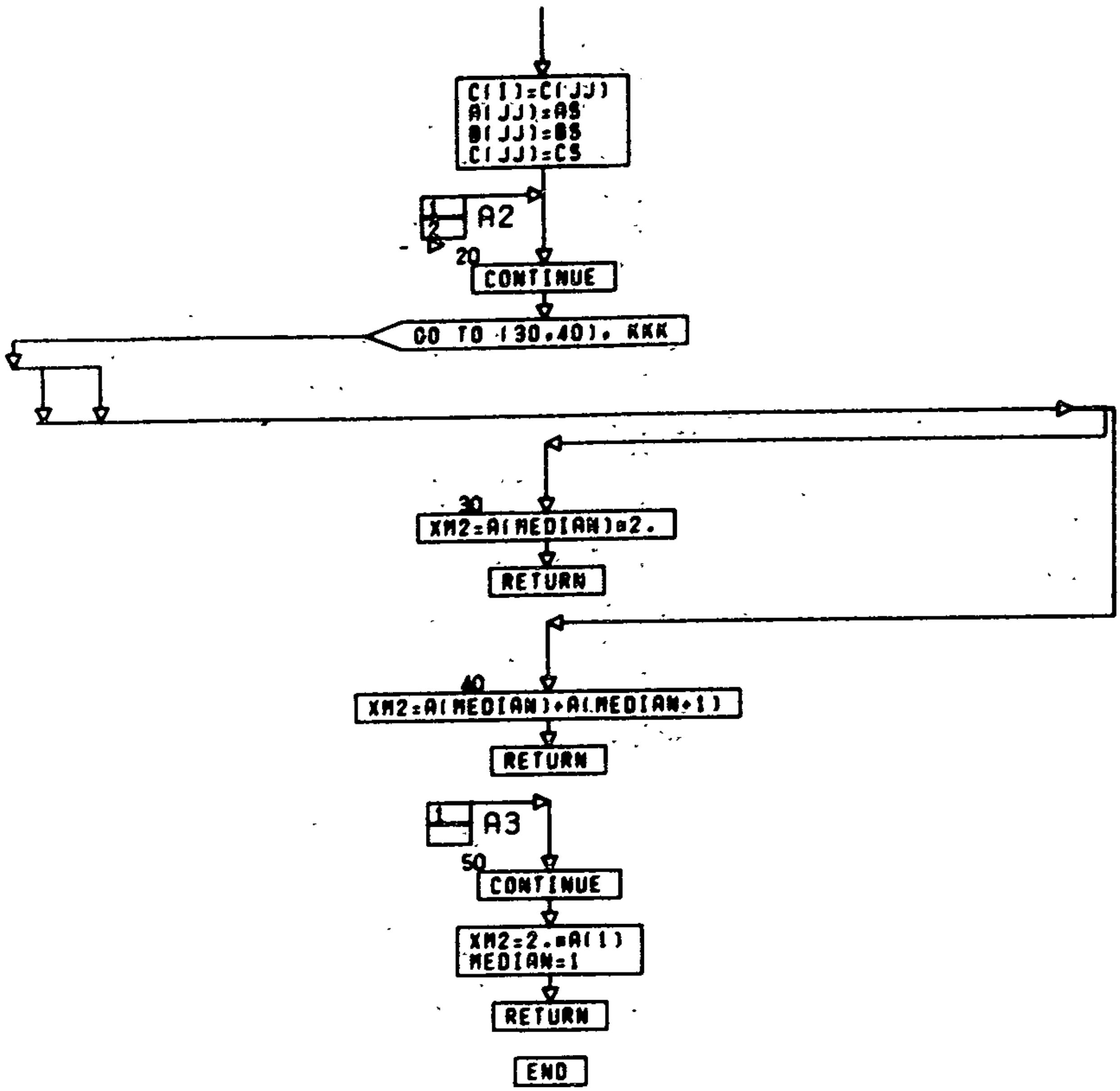
PG 22 FINAL


SUBROUTINE ORDER (N,A,B,C,XM2,MEDIAN)
C ORDERS ARRAYS AND GETS MEDIAN VALUES
DIMENSION A(1), B(1), C(1)
IF (N .EQ. 1)
F
T
GO TO 50
3
A3
MEDIAN=N/2
KK=MEDIAN*2
KKK=2
IF (KK.NE.N)
F
T
KKK=1
C KKK = 1 , ODD NUMBER OF POINTS
DO 20 I=1,N
3
IF (A(I).EQ.0.)
F
2
A1
T
GO TO 20
3
A2

CONT. ON PG 2


A1
XLO=A(I)
JJ=I
DO 10 J=I,N
IF (XLO.GE.A(J))
F
T
GO TO 10
XLO=A(J)
JJ=J
10
CONTINUE
IF (I.EQ.JJ)
F
T
GO TO 20
3
A2
AS=A(I)
BS=B(I)
CS=C(I)
A(I)=A(JJ)
B(I)=B(JJ)

CONT. ON PG 3


C(I)=C(JJ)
A(JJ)=AS
B(JJ)=BS
C(JJ)=CS
1
2
A2
20
CONTINUE
GO TO (30,40), KKK
30
XM2=A(MEDIAN)*2.
RETURN
40
XM2=A(MEDIAN)+A(MEDIAN+1)
RETURN
1
A3
50
CONTINUE
XM2=2.*A(1)
MEDIAN=1
RETURN
END

PG 3 FINAL

```
SUBROUTINE MIS (IPIC,IERR,ITER,NCONF,ICHOSE,NCHOSE)
DIMENSION IPIC(2), ICHOSE(2), NCONF(6), NCHOSE(2)
```

```
COMMON /USER3/ARRAYN(11,3), BTRMX,    NMSEQ,    OPSMS,    SCSFL,
              TPRFL
```

```
COMMON /BTWN/      ACSSN,     ACSWP,        ALT,       AREA,    BATCAP,
               BITRAT(2),     CLIFE,     CONVWT,          D,        DT,
                      DX,        DY,         DZ,      EOBLG,    EOBSID,
                      FC,        FF,     HARNWT,        HPT,    HTPIPE,
                    HTPT,    HTRPRB,     HTRPWR,                IBTLOC,
                   LMBDD,        NC,     OMEGS,      PASSTR,        PJ,
                      PL,     PLMIN,     POCNWT,       RADA,    RADAB,
                     RAT,        RJ,     SABOLG,      SATLG,   SATTWT,
```

```
                   SATWT,    SATXCG,     SATYCG,     SATZCG,    SA1XL,
                   SA1YL,     SA1ZL,       SIDE,      SYSLB,   THCMWT,
               THRUST(2),        TI,      TNKWT,      TPRIM,       VB,
                    VCHP,       VOL,       WATE,         WB,      WBT,
                      WT,        XJ,     XNZERO,         YJ,       ZJ
```

```
COMMON /DBCOM/DATAB(55,100),IDB(30)
```

```
COMMON /CHOSE/     COST(5,60),       ARRAY(11,60),       ICHOSC(60),
                   NCHOSC(60),       REL ( 6,60),        SKD(7,60),
                   THM(4,60)
```

```
COMMON/PRTCOM/    ACCRCY,          AM,          AN,          BF,          BS,
              COPI(7,2),     CISTAR,        CTOT,        DDTE,          DE,
                  DRIWT,     EOBSTR,      FEEINV,      FEEOPS,        FEER,
                    GSE,       IREL,      ITRUNC,   MMDOLD,NAME(3,60),
                    OPS,     PAYINV,      PAYOUL,        PAYR,          PE,
                    PMP,        PMR,    POWER(6),          PU,     PWR(60),
                    QCP,        QCR,    ROLD(60),      SABMWT,      SATADP,
                 SATINV,       SATR,        SEIP,        SEIR,   SKTAU(6),
```

```
             SSREL(6),   SUBE(7),    SUBT(7),  SUBUE(7),  SUBUP(7),
                   TA,  TAU(6,6),         TB,         TC,         TE,
                   TF,     TOOLR,      TOOLU,     TOTOPS,      TRUNC,
                   TS,        TTT,VOLUME(6),    VOL(60),WEIGHT(6),
                XLTOT,      XMEH,     XMEINV,       XMEL,      XMEVL,
                 XMEW,     XMEWT,      XVEST
```

```
DIMENSION HSRT(60),TLPTH(60),GRANH(60),XSRT(60),TLPTL(60),
          GRANL(60)
```

```
C           INPUTS  FOR DATA PROCESSING SUBSYSTEMS - MIS
C   INPUT   COPI    T D SOURCE  UNITS  DESCRIPTION
C   VAR.    IN.
C   GRANH   36      R Y ALL S/S        GRANULARITY HIGH RATE TABLE
C   HSRT    35      R Y ALL S/S SPS    SAMPLE RATE HIGH TABLE
C   TLPTH   34+35   R Y ALL S/S        NO OF ANOL AND DIG POINTS HIGH
C   GRANL   40      R Y ALL S/S        GRANULARITY LOW RATE TABLE
C   XSRT    39      R Y ALL S/S SPS    SAMPLE RATE LOW TABLE
```

CONT. ON PG .2

```
C   TLPTL   37+38   R Y ALL S/S        NO OF ANOL AND DIG POINTS LOW
C   SCSFL           R    U             SPECIAL COMMAND SYNC FLAG
C   TOTCM   30TO32  R    DB            TOTAL NO OF COMMANDS
C   COMTY           R    MACRO         NCONF(3) - SPEC OR GEN COMPUTER FLAG
C   TTCPL   32      R                  TIME TAG COMMAND FLAG
C   TPRFL           R    U             TELEM PROCESS FLAG
C   ACSSN           R    SC            SUM OF ACS  SENSOR
C   COMRT           R    COMM          COMMAND RATE
```

```
C   OPSMS           R    U      SEC-1  MISSION OPS
C   MISPD           I    U             MISSION DATA PROC. FLAG
C              ERROR FLAGS
C              IERR = 1    MUX IS REQUIRED
C              IERR = 10   WORD LENGTH GREATER THAN 256
C              IERR = 100  BIT RATE IS TOO LARGE
C              IERR = 1000 SPECIAL COMMAND SYNC FLAG IS NOT EQUAL TO ZERO
C           IERR = 10000  J1 .GE. J1E
```

```
IERR=0
IERR1=0
IERR2=0
IERR3=0
IERR4=0
IERR5=0
ANOLH=0.
ANOLL=0.
```

```
MUX=0
```

```
C           COMPUTE TABLES
```

```
TOTCM=0
TTCFL=0
NTABH=0
NTABL=0
```

```
C   ***********  WE NEED NTABN  ********************************
```

```
NTABN= NMSEQ
```

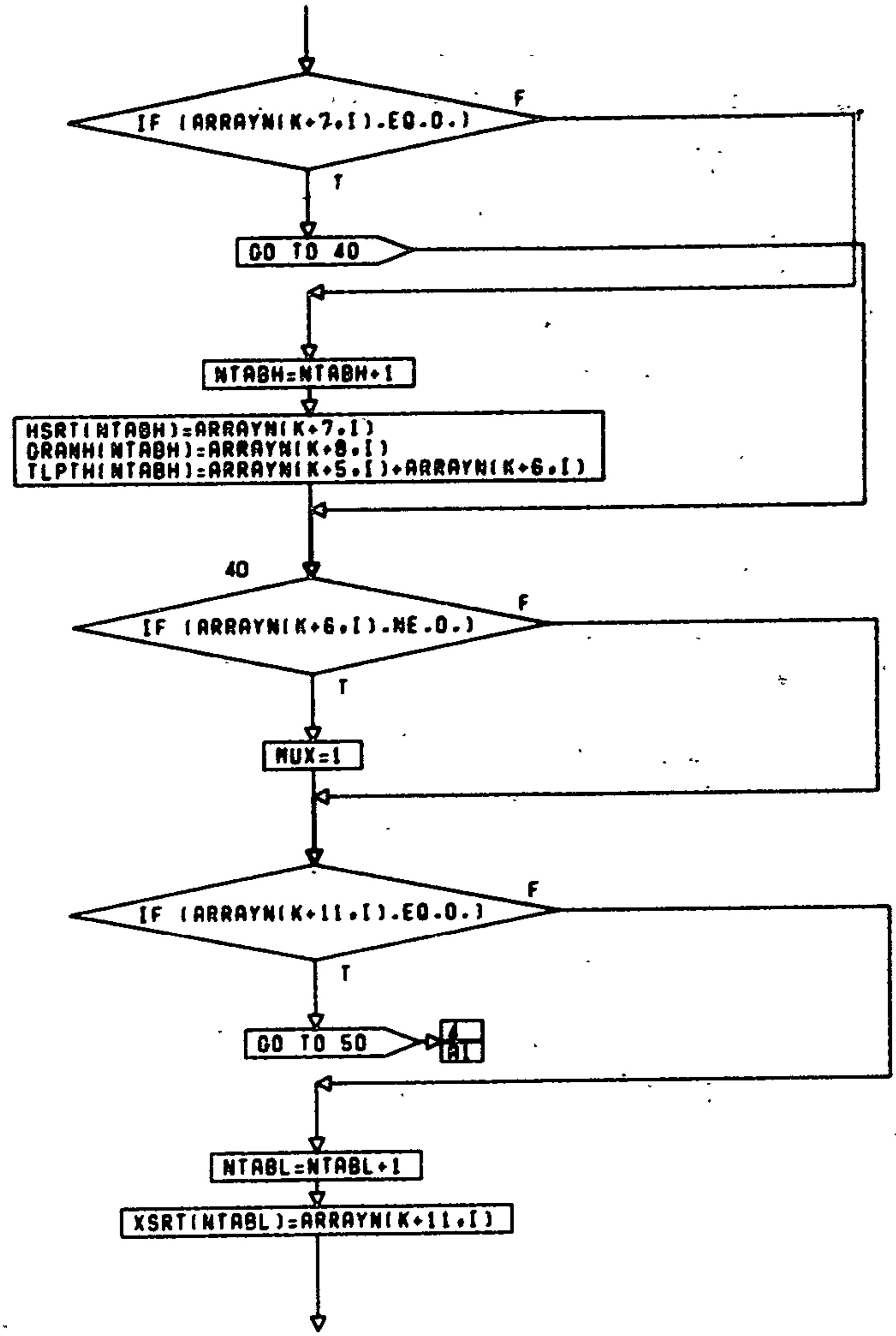
```
C   ************************************************************
```

```
K= -1
```

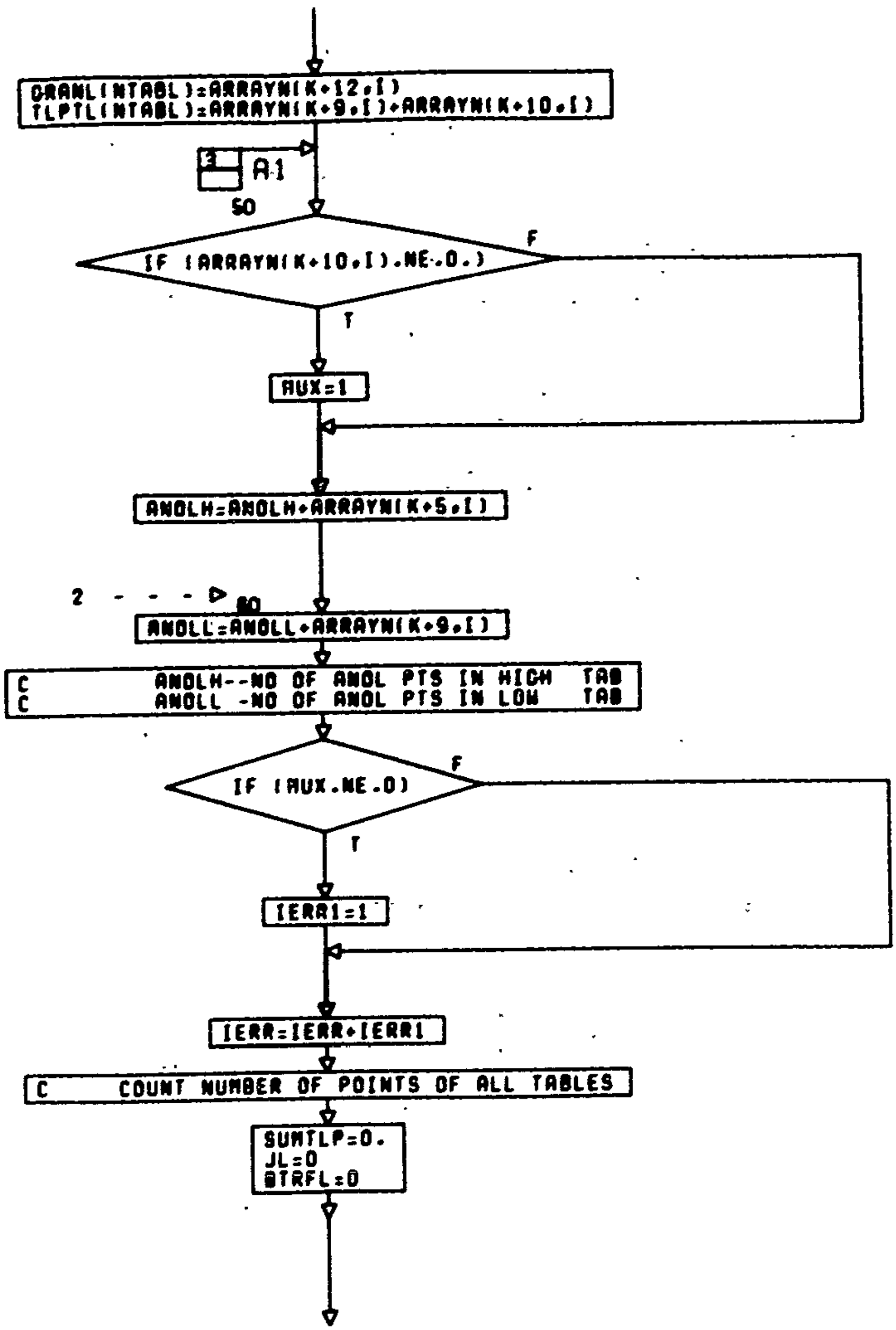
```
DO 60 I=1,NTABN    - - - -  > 4
```

```
TOTCM=TOTCM+ARRAYN(K+2,I)+ARRAYN(K+3,I)+ARRAYN(K+4,I)
TTCFL=TTCFL+ARRAYN(K+4,I)
```

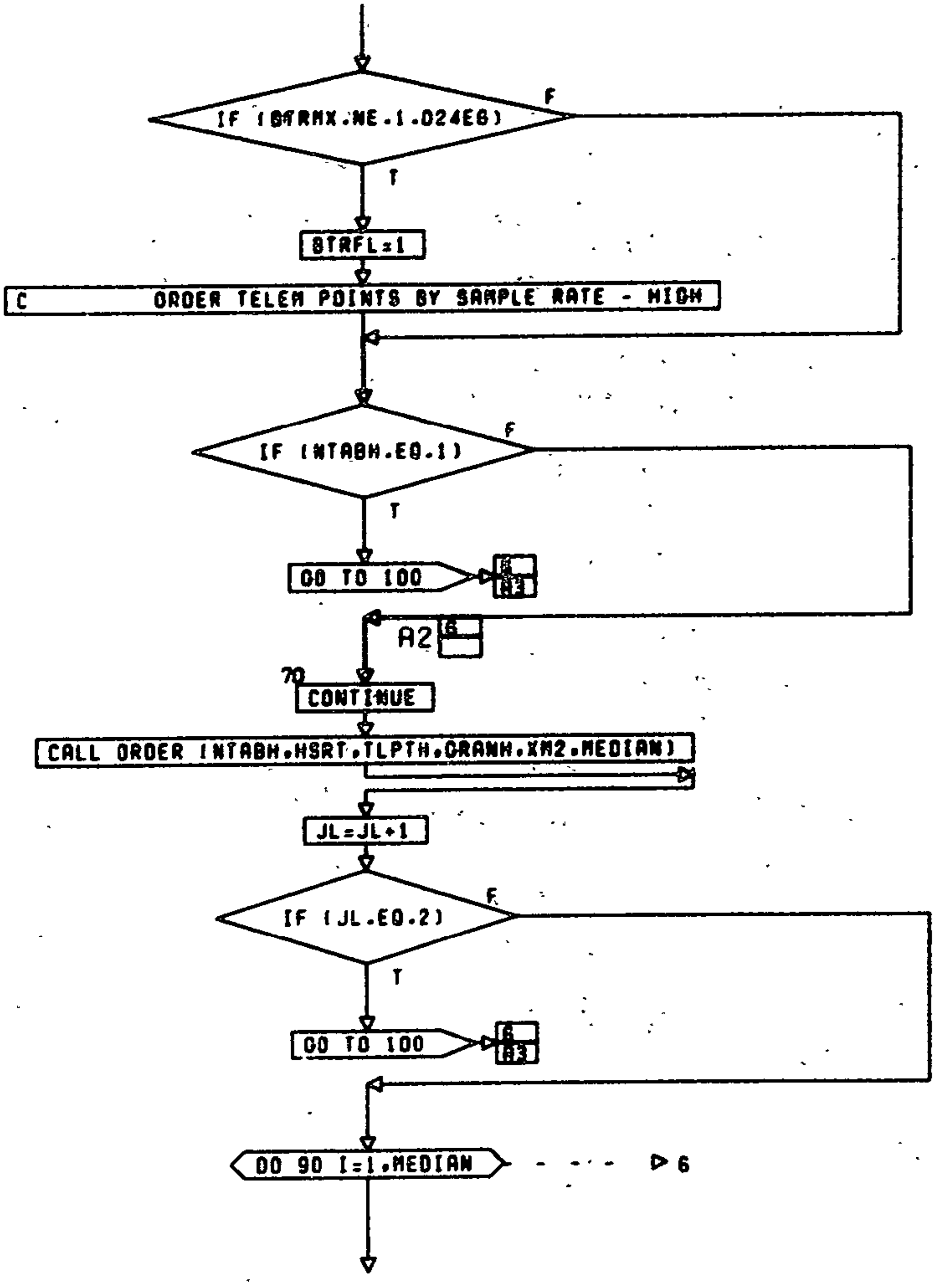
CONT. ON PG 3


IF (ARRAYN(K+7,I).EQ.0.)
F
T
GO TO 40
NTABH=NTABH+1
HSRT(NTABH)=ARRAYN(K+7,I)
ORANH(NTABH)=ARRAYN(K+8,I)
TLPTH(NTABH)=ARRAYN(K+5,I)+ARRAYN(K+6,I)
40
IF (ARRAYN(K+6,I).NE.0.)
F
T
MUX=1
IF (ARRAYN(K+11,I).EQ.0.)
F
T
GO TO 50
4
A1
NTABL=NTABL+1
XSRT(NTABL)=ARRAYN(K+11,I)

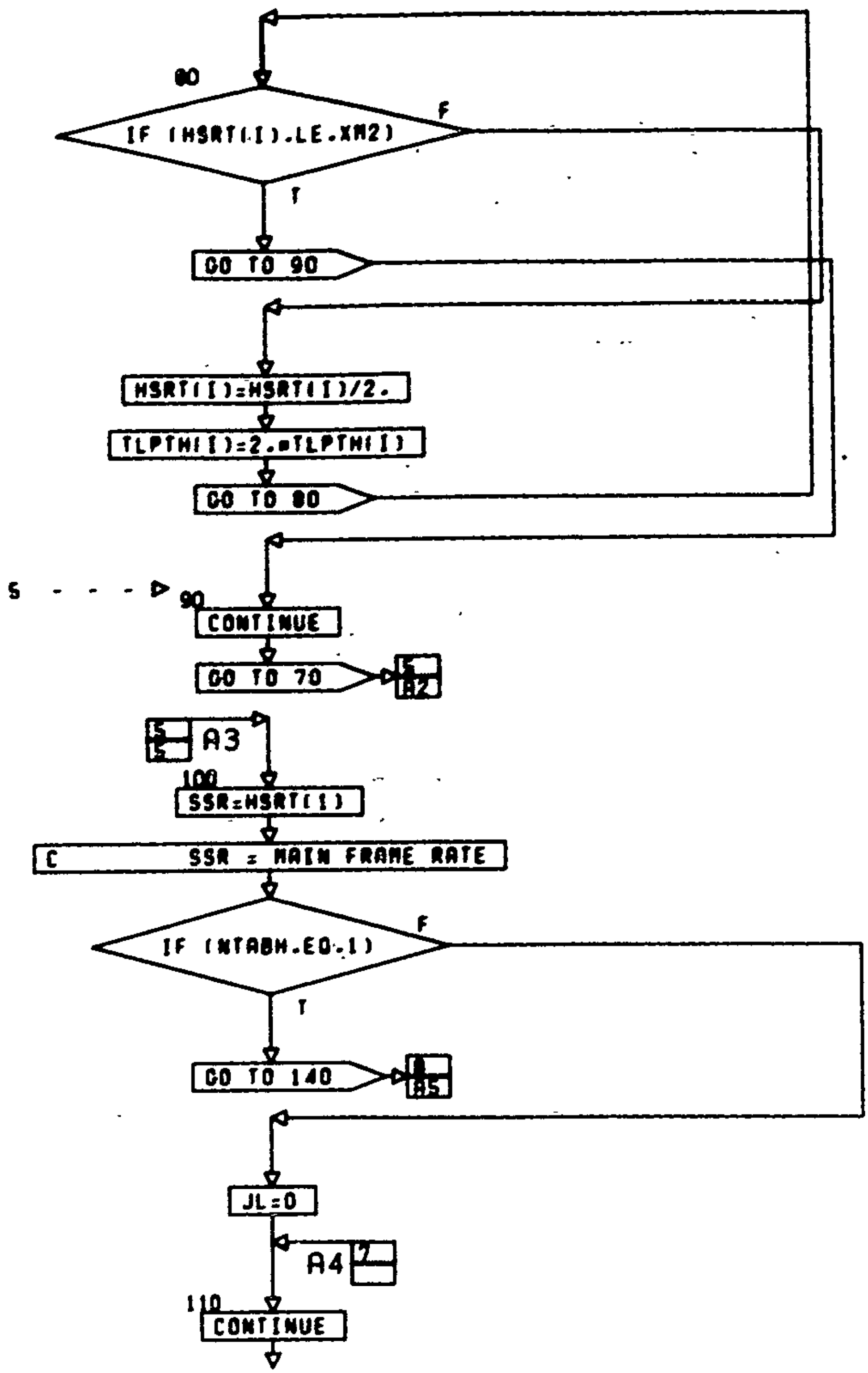
CONT. ON PG 4


ORANL(NTABL)=ARRAYN(K+12,I)
TLPTL(NTABL)=ARRAYN(K+9,I)+ARRAYN(K+10,I)
3
A1
50
IF (ARRAYN(K+10,I).NE.0.)
F
T
AUX=1
ANOLH=ANOLH+ARRAYN(K+5,I)
2
80
ANOLL=ANOLL+ARRAYN(K+9,I)
C ANOLH--NO OF ANOL PTS IN HIGH TAB
C ANOLL -NO OF ANOL PTS IN LOW TAB
IF (AUX.NE.0)
F
T
IERR1=1
IERR=IERR+IERR1
C COUNT NUMBER OF POINTS OF ALL TABLES
SUMTLP=0.
JL=0
QTRFL=0

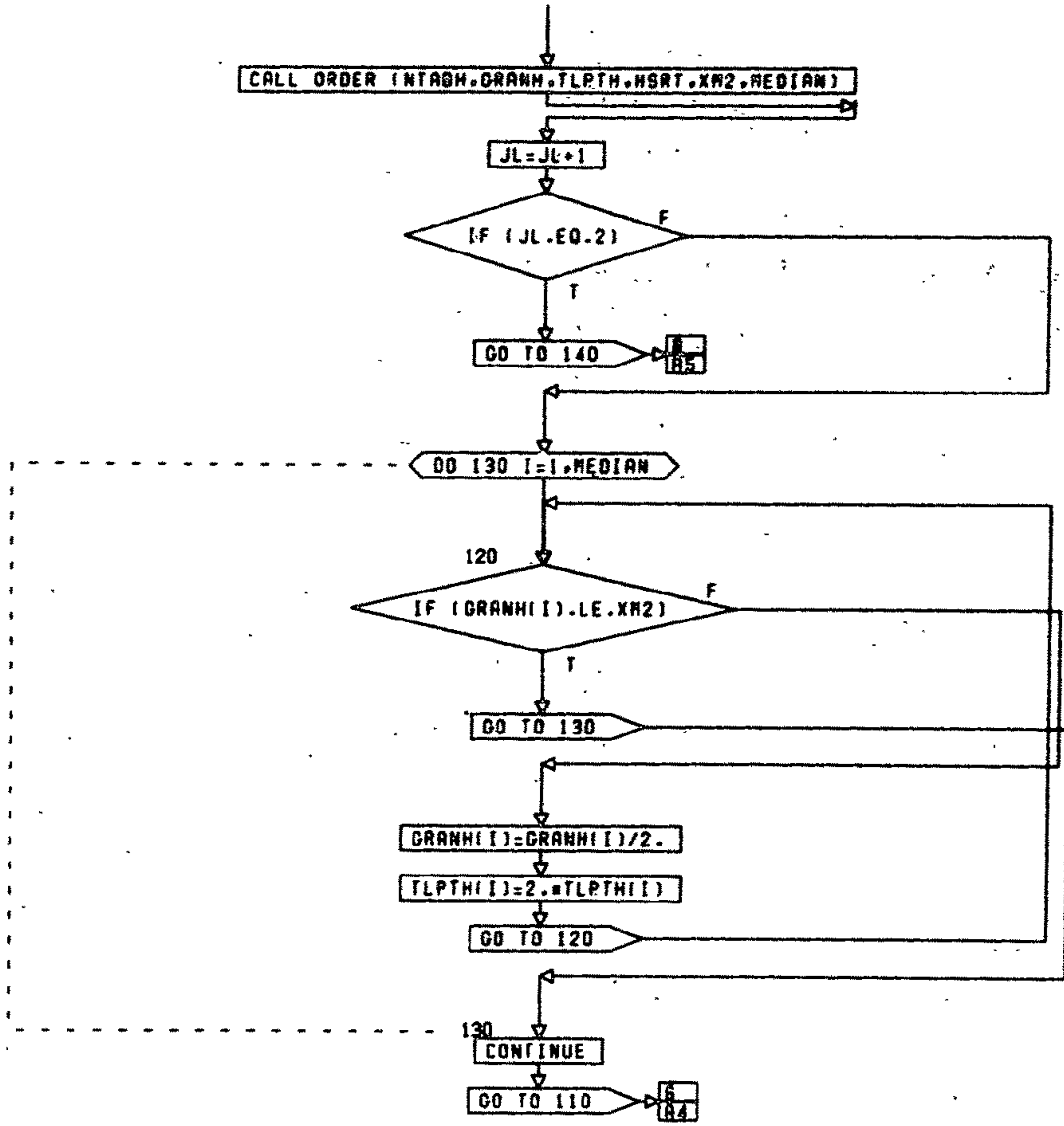
CONT. ON PG 5


IF (BTRMX.NE.1.D24E6)
F
T
BTRFL=1
C ORDER TELEM POINTS BY SAMPLE RATE - HIGH
IF (NTABH.EQ.1)
F
T
GO TO 100
6
A3
A2
6
70
CONTINUE
CALL ORDER (NTABH,HSRT,TLPTH,ORANH,XM2,MEDIAN)
JL=JL+1
IF (JL.EQ.2)
F
T
GO TO 100
6
A3
DO 90 I=1,MEDIAN
6

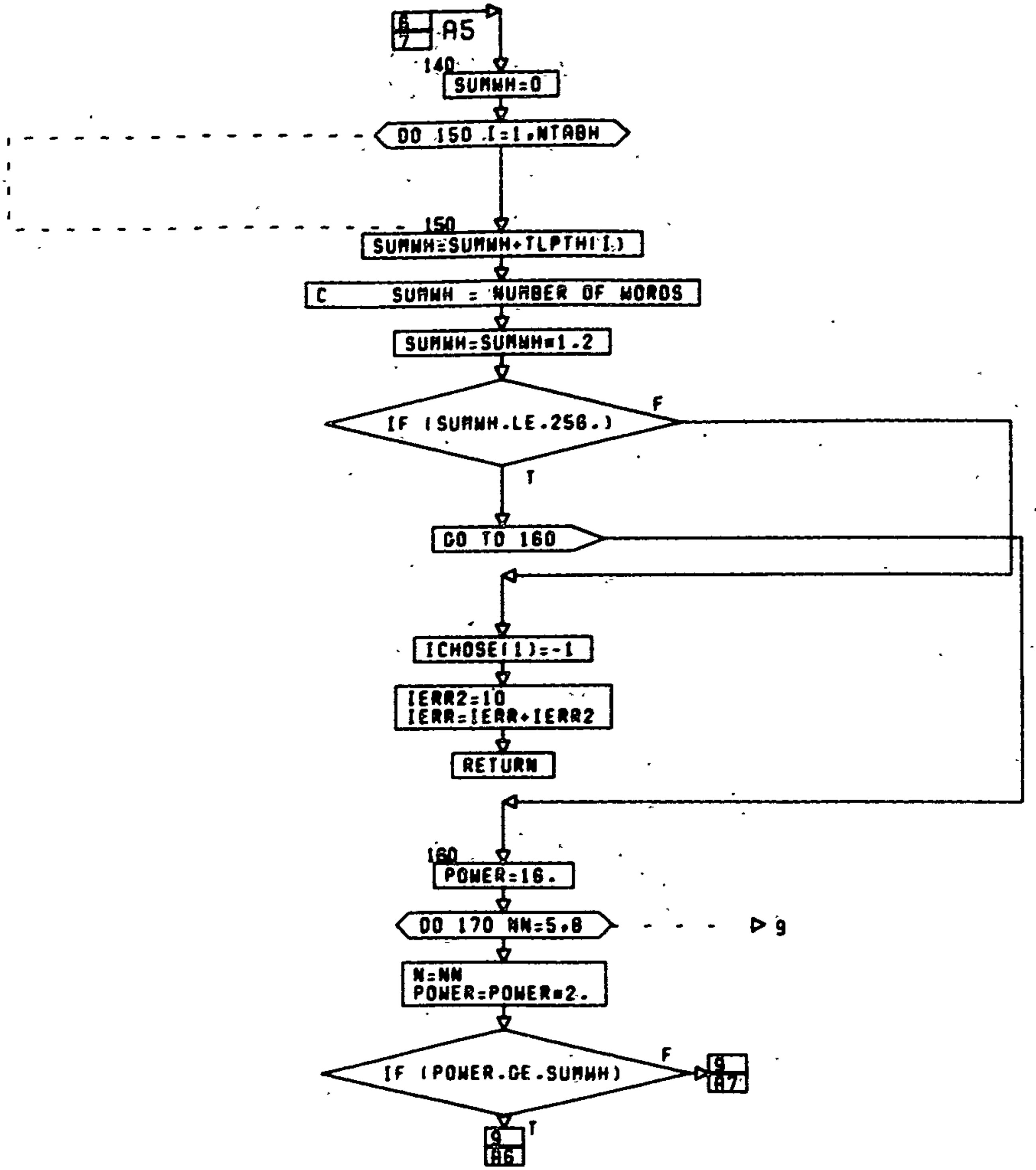
CONT. ON PG 6


80
IF (HSRT(I).LE.XM2)
F
T
GO TO 90
HSRT(I)=HSRT(I)/2.
TLPTH(I)=2.*TLPTH(I)
GO TO 80
5
90
CONTINUE
GO TO 70
5
A2
5
5
A3
100
SSR=HSRT(I)
C SSR = MAIN FRAME RATE
IF (NTABH.EQ.1)
F
T
GO TO 140
8
A5
JL=0
A4
7
110
CONTINUE

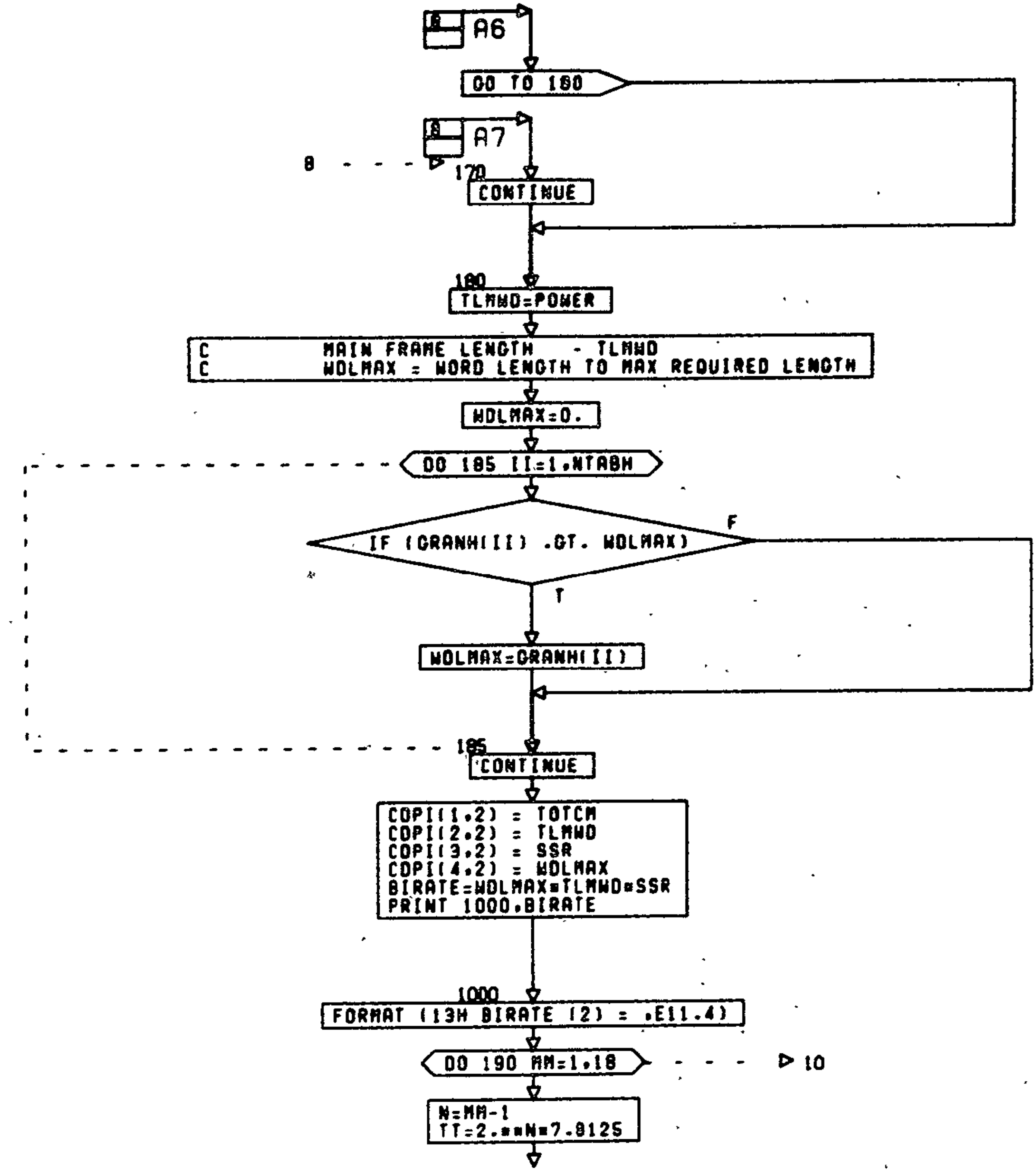
CONT. ON PG 7


CALL ORDER (NTABH,GRANH,TLPTH,HSRT,XM2,MEDIAN)
JL=JL+1
IF (JL.EQ.2)
F
T
GO TO 140
8
A5
DO 130 I=1,MEDIAN
120
IF (GRANH(I).LE.XM2)
F
T
GO TO 130
GRANH(I)=GRANH(I)/2.
TLPTH(I)=2.*TLPTH(I)
GO TO 120
130
CONTINUE
GO TO 110
6
A4

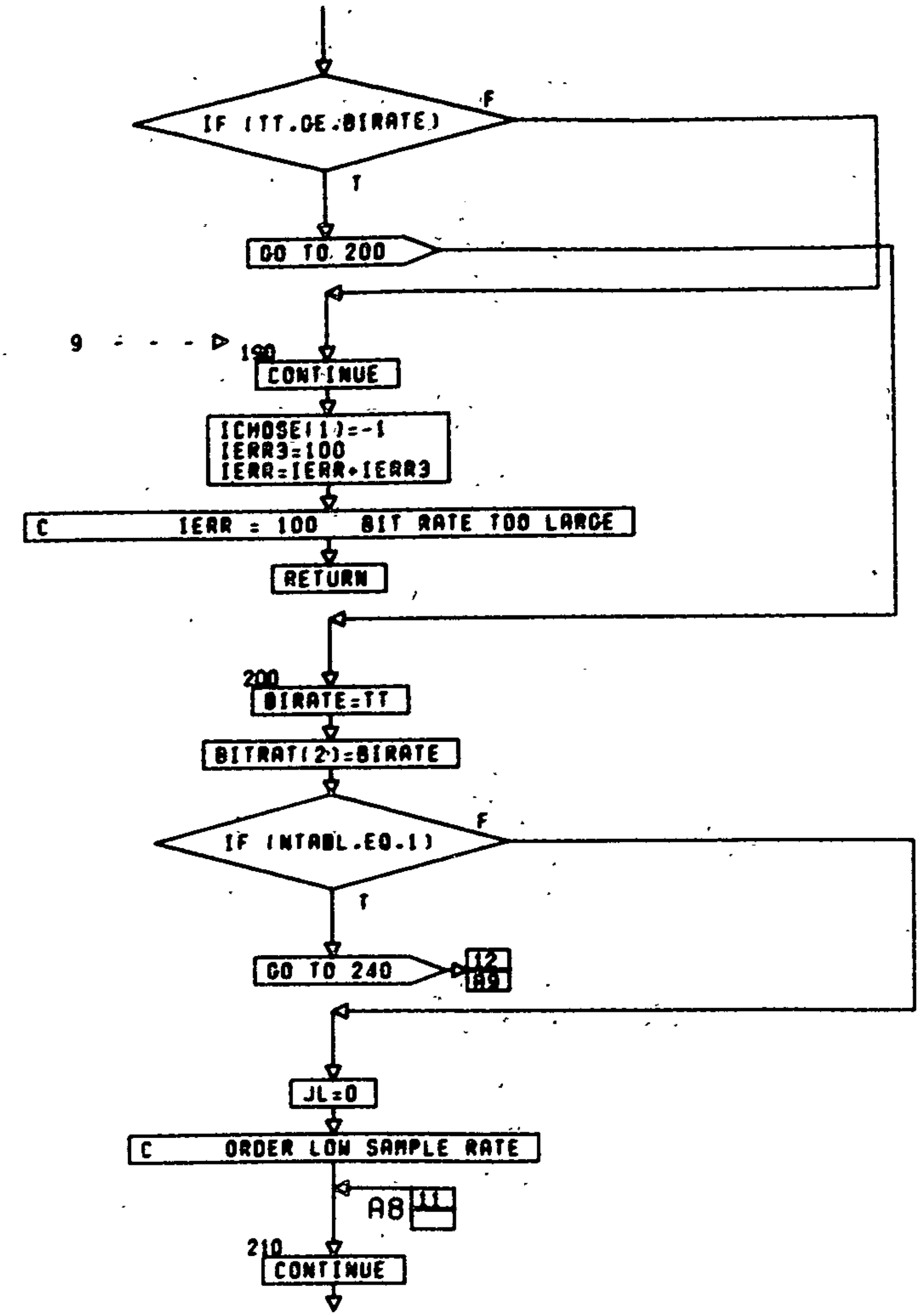
CONT. ON PG 8


A5
140
SUMWH=0
DO 150 I=1,NTABH
150
SUMWH=SUMWH+TLPTH(I)
C SUMWH = NUMBER OF WORDS
SUMWH=SUMWH*1.2
IF (SUMWH.LE.256.)
F
T
GO TO 160
ICHOSE(1)=-1
IERR2=10
IERR=IERR+IERR2
RETURN
160
POWER=16.
DO 170 NN=5,8
9
N=NN
POWER=POWER*2.
IF (POWER.GE.SUMWH)
F
9
A7
T
9
A6

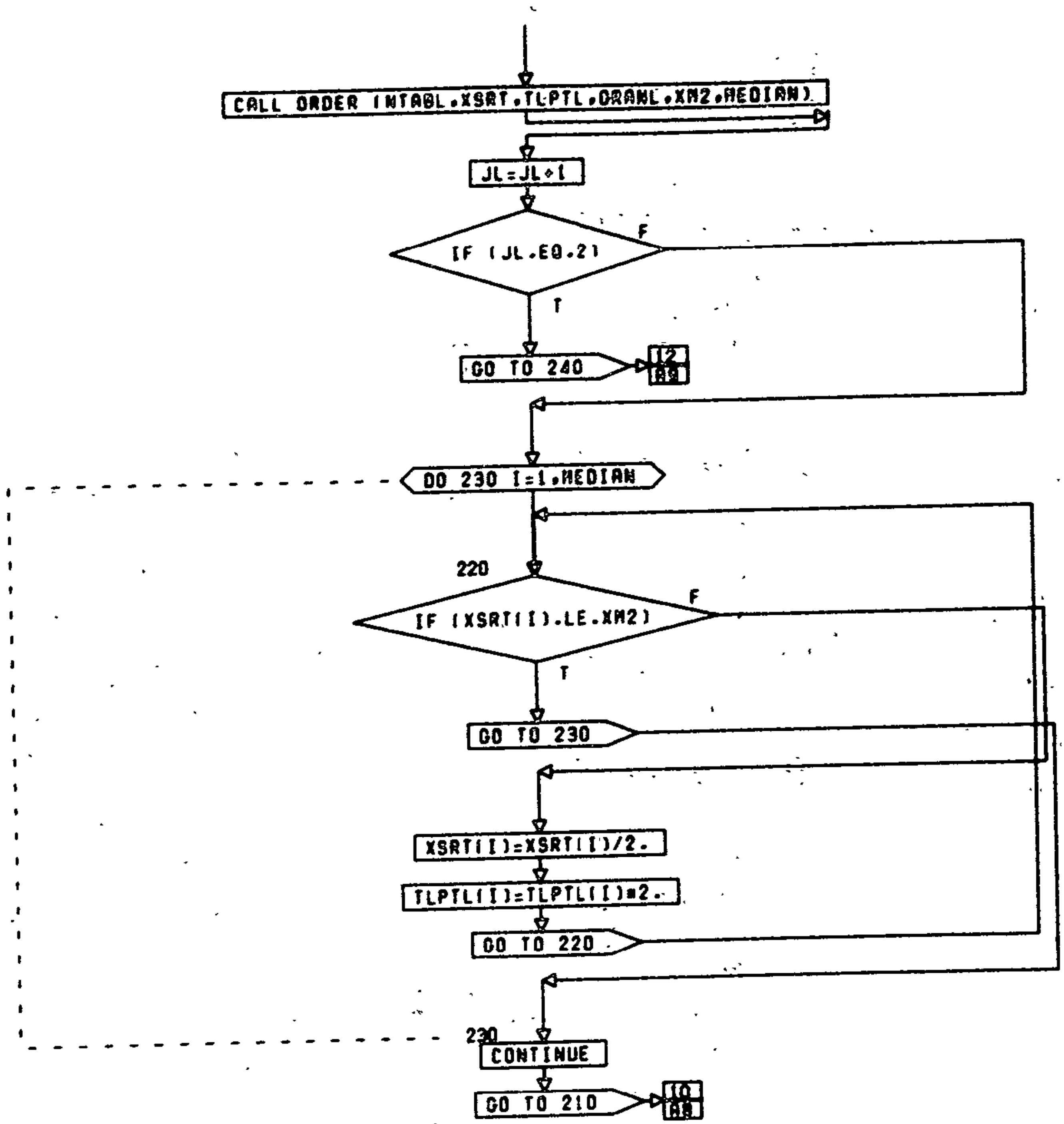
CONT. ON PG 9


A6
DO TO 180
A7
8
170
CONTINUE
180
TLMWD=POWER
C MAIN FRAME LENGTH - TLMWD
C WDLMAX = WORD LENGTH TO MAX REQUIRED LENGTH
WDLMAX=0.
DO 185 II=1,NTABH
IF (GRANH(II) .GT. WDLMAX)
F
T
WDLMAX=GRANH(II)
185
CONTINUE
COPI(1,2) = TOTCM
COPI(2,2) = TLMWD
COPI(3,2) = SSR
COPI(4,2) = WDLMAX
BIRATE=WDLMAX*TLMWD*SSR
PRINT 1000,BIRATE
1000
FORMAT (13H BIRATE (2) = ,E11.4)
DO 190 MM=1,18
10
N=MM-1
TT=2.**N*7.8125

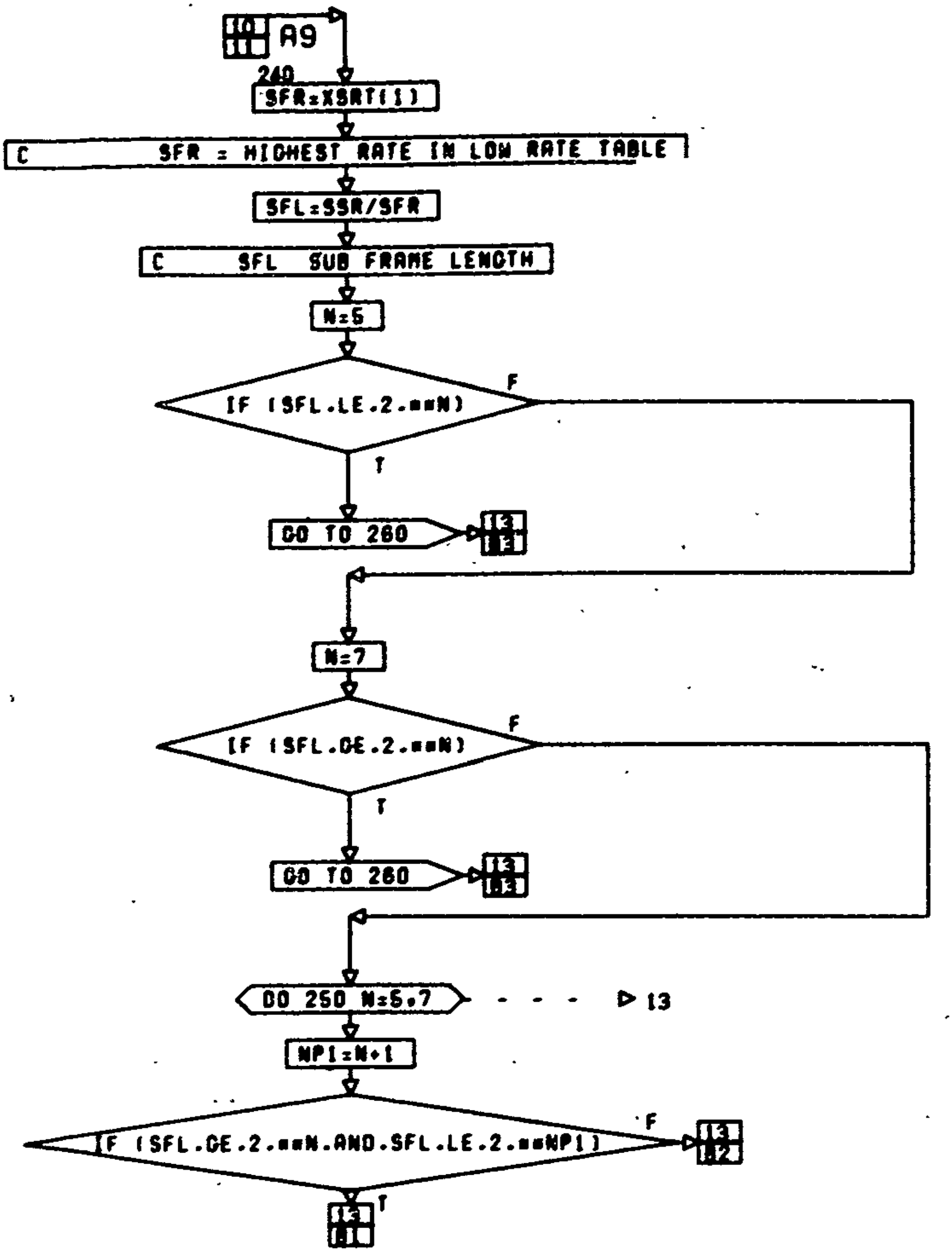
CONT. ON PG 10


IF (TT.GE.BIRATE)
F
T
GO TO 200
9
190
CONTINUE
ICHOSE(1)=-1
IERR3=100
IERR=IERR+IERR3
C IERR = 100 BIT RATE TOO LARGE
RETURN
200
BIRATE=TT
BITRAT(2)=BIRATE
IF (NTABL.EQ.1)
F
T
GO TO 240
12
A9
JL=0
C ORDER LOW SAMPLE RATE
A8
11
210
CONTINUE

CONT. ON PG 11

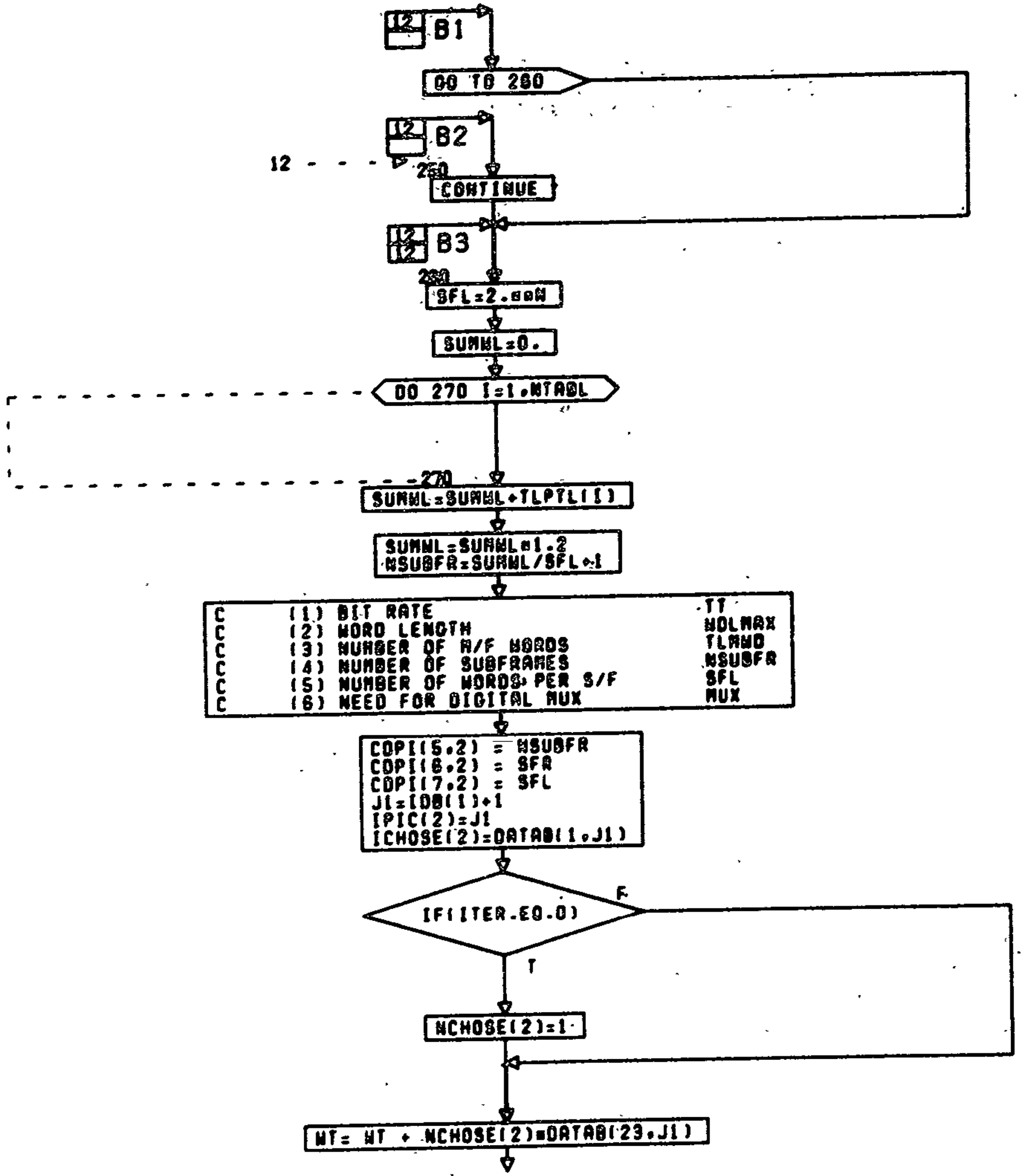

CALL ORDER (NTABL,XSRT,TLPTL,ORANL,XM2,MEDIAN)
JL=JL+1
IF (JL.EQ.2)
F
T
GO TO 240
12
A9
DO 230 I=1,MEDIAN
220
IF (XSRT(I).LE.XM2)
F
T
GO TO 230
XSRT(I)=XSRT(I)/2.
TLPTL(I)=TLPTL(I)*2.
GO TO 220
230
CONTINUE
GO TO 210
10
A8

CONT. ON PG 12



A9
240
SFR=XSRT(1)
C SFR = HIGHEST RATE IN LOW RATE TABLE
SFL=SSR/SFR
C SFL SUB FRAME LENGTH
N=5
IF (SFL.LE.2.**N)
F
T
GO TO 260
N=7
IF (SFL.GE.2.**N)
F
T
GO TO 260
DO 250 N=5,7
13
NP1=N+1
IF (SFL.GE.2.**N.AND.SFL.LE.2.**NP1)
F
T

CONT. ON PG 13



CONT. ON PG 14

PG 13F 14

```
VOL= VOL + NCHOSE(2)*DATAB(24,J1)
PL= PL + NCHOSE(2)*DATAB(16,J1)
PLMIN= PLMIN + NCHOSE(2)*DATAB(18,J1)
```

RETURN

END

END

PG 14 FINAL

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REPORT TITLE

Systems Cost/Performance Analysis (Study 2.3) Final Report
Volume III: Programmer's Manual and User's Guide

REPORT NO.	PUBLICATION DATE	SECURITY CLASSIFICATION
ATR-75(7363)-3, Vol. III	31 March 1975	Unclassified

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